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A MANUAL
OF
MATERIA MEDICA
AND
PHARMACOLOGY.

COMPRISING ALL
ORGANIC AND INORGANIC DRUGS WHICH ARE OR HAVE BEEN OFFICIAL IN THE UNITED STATES PHARMACOPŒIA,
TOGETHER WITH
IMPORTANT ALLIED SPECIES AND USEFUL SYNTHETICS,

ESPECIALLY DESIGNED FOR STUDENTS OF PHARMACY AND MEDICINE, AS WELL AS FOR DRUGGISTS, PHARMACISTS, AND PHYSICIANS.

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PREFACE TO THE SIXTH EDITION.

When the preliminary draft of the Ninth Decennial Revision of the U. S. Pharmacopœia appeared two years ago, indicating important and radical changes in the proposed text, the author at once began conforming this work to that standard—rewriting many subjects and bringing all within current scientific thought. That labor, conceded from the first somewhat prodigious, has drawn its "slow length along," sustained by inherent duty and sentiment, until its completion—a form considered greatly in advance of its predecessors. Advantage has also been taken of the Fourth Edition of the *National Formulary* to the extent of embracing most of its drugs and preparations in abstract, with doses whenever necessary—a logical inclusion believed imperative in order to afford the student a positive familiarity with both of our legal authorities.

The arrangement of the drugs remains strictly the same as that followed in previous editions, being based upon the principle of *associating as nearly together as possible those substances, organic and inorganic, which have a common or allied origin, allowing those next related to follow in regular order, the basal or parental source thus being kept paramount.* Vegetable drugs, therefore, appear in the order of natural historic relationship of the plants from which obtained—*i. e.*, botanic sequence, beginning with the more simple and gradually approaching those more complex. That this might be possible and in accord with Nature's process of evolution, the classification of Engler and Prantl, as enunciated in their *Die Natürlichen Pflanzenfamilien,* has been followed, modified, however, occasionally in accordance with Engler's *Syllabus der Pflanzenfamilien,* and also Britton and Brown's *Illustrated Flora.* Animal drugs also are treated so as to be in harmony with this great natural law of development of the animals from which obtained—*i. e.*, zoölogic sequence, beginning with the lower and proceeding always to those of higher organization. Organic drugs, carbon and synthetic compounds are arranged similarly, their chemical relationship, however, being borne always in mind.

Measurements are expressed in the metric system, followed by approximate equivalents in the English, and temperature is stated in both Centigrade and Fahrenheit scales, thereby giving an equal opportunity for use according to individual preference. Doses are stated in the apothecaries' and metric system, in the hope that the easy comparison of parallel quantities may produce a stronger mental impression, and thereby become an element toward metric education. The abbreviation Ml. (millilitre) has been given preference, that of Cc. (cubic centimetre) following parenthetically.

The accent of generic and specific names continues to be placed on the final letter, consonant or vowel, of the accented syllable (not simply upon the vowel of that syllable)—certainly the most rational method, and one by which it is believed the student will obtain more readily an intelligent idea of pronunciation. Several pages will be found devoted to the pronunciation of words more or less troublesome to the average student, the aim having been to follow the best philologists rather than general usage.

The treatise on the microscope has been retained, not so much in the belief that it represents a sufficiently exhaustive exposition of the subject, as the hope that the primitive essentials there outlined may suggest to pharmacists and physicians, at least, the importance of the domain and the ultimate need in it of even more advanced and technical knowledge.

A number of new illustrations, elucidating plant characteristics, have been introduced in the hope of aiding visual instruction.

The work, in its entirety, approaching nearer a new than a revised one, has had to have, from the mechanical side, a resetting and recasting, the older plates being discarded *in toto*, certainly most conducive to the fullest liberty at remodeling for improvement—a privilege that has unstintingly been exercised.

The author wishes to renew his sense of gratitude to those who in their teaching have used the work, thereby aiding its dissemination, and to those who have contributed suggestions as well as encouragement, thereby leading to its betterment. Especially is he indebted to the publishers for an increasing interest and willingness to perform, in accordance with highest art, their portion of the labor.

DAVID M. R. CULBRETH, M.D.

BALTIMORE, 1917.

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ABBREVIATIONS USED THROUGHOUT THIS WORK.

The degree sign (°) associated with numerals indicates *feet*, except when accompanied with the capital letters C. and F., then it represents *degrees* (temperature); the prime sign (′) attached to figures is used for *inches*, but when following vowels or consonants denotes the *accented syllable*.

Ar., Arabic.
Abs., abs., Absence.
Fldext., Fluidextract.
Br., British.
Br. P., British Pharmacopœia.
Cod., Codex, French Pharmacopœia.
Cult., cult., Cultivated.
Dif., dif., Difference.
Dist., dist., Distilled, Distinction.
Eng., English.
Fr., French.
Ger., German.
Ger. P. or Ger. Phar., German Pharmacopœia.
Gr., Greek.
Heb., Hebrew.
Hind., Hindoo.
Nat., nat., Naturalized.
Lim., lim., Limit.
OE., Old English.
Per., Pers., Persian.
Peruv., Peruvian.
Portg., Pg., Portuguese.
Skr., Skt., Sanskrit.
Sp., Spanish.
C., Centigrade.
F., Fahrenheit.
Mt., Mount, Mountain.
Adj., adj., Adjective.
Dim., dim., Diminutive.
Contr., contr., Contraction.
Prep(s)., Preparation(s).
P. p., pp., Past participle.
Unoff., Unofficial.
Syn., Synonym.
Fr., fr., From.
Tr., Tinct., Tincture.
Dil., dil., Dilute(d).
Alc., alc., Alcohol.
T. S., Test Solution.
V. S., Volumetric Solution.
$\frac{N}{10}$, Decinormal.
Sp. gr., Specific gravity.
U. S. P., United States Pharmacopœia.
Q. S., q. s., Sufficient quantity.
P. c., p. c., Per cent(um).
Cc., Cubic centimetre.
L., Litre.
Ml., Millilitre.
M., Metre.
Mm., Millimetre.
Cm., Centimetre.
Gm., Gramme.
Kg., Kilogramme.
Kl., Kilolitre.
Km., Kilometre.
♏, min., Minim.
Gr., gr., Grain.
℔, Pound.
ʒ, Drachm (solid or fluid).
℥, Ounce (solid or fluid).
℈, Scruple.
ss, Half.
+ (plus), − (minus).
× (multiplication).
= (equals), □ (square).

THE GREEK ALPHABET.

Α	α	a	Alpha.	Ν	ν	n	Nu.
Β	β	b	Bēta.	Ξ	ξ	x	Xi.
Γ	γ	g	Gamma.	Ο	ο	o short . . .	Omīcron.
Δ	δ	d	Delta.	Π	π	p	Pi.
Ε	ε	e short . . .	Epsīlon.	Ρ	ρ	r	Rho.
Ζ	ζ	z	Zēta	Σ	σ ς	s	Sigma.
Η	η	e long . . .	Eta.	Τ	τ	t	Tau.
Θ	θ ϑ	th	Thēta.	Υ	υ	u	Upsīlon.
Ι	ι	i	Iota.	Φ	φ	ph	Phi.
Κ	κ	k	Kappa.	Χ	χ	ch	Chi.
Λ	λ	l	Lambda.	Ψ	ψ	ps	Psi.
Μ	μ	m	Mu.	Ω	ω	o long . . .	Omĕga.

MATERIA MEDICA AND PHARMACOLOGY.

Disease seems to have been man's natural inheritance, while curative methods and remedies are largely his adaptation and creation. From early biblical times the ills "that flesh is heir to" were recognized as a deadly menace to the human family, and whether the vain appeal was made, then or since, to either (for each in turn enjoyed a period of favor) fetichism, sorcery, religious incantations, faith, Christian science, astrology, magic-art, enchantment, witchcraft, spells, charms, hydropathy, venesection, or drugs, the same inherent hope and purpose ever has prevailed—to relieve and palliate physical suffering. Human thought, happily, is no longer so speculative and superstitious, consequently universal intelligence has allowed medical appliances and treatment to be shaped into a systematic and veritable science.

Materia Medica (L. medical material) is a treatise upon the materials, agents, or appliances used in medicine—including their name, source (origin), habitat, family (natural order—organic), physical characteristics, methods by which obtained, tests for purity and adulterations, constituents (composition), forms of administration (preparations), physiological action (properties), uses (therapeutics—therapy), normal and lethal doses, antagonists, incompatibilities, synergists (organic and inorganic), and other important features.

Pharmacology (Gr. *φάρμακον*, a drug, medicine, + *λόγος*, discourse) is a similar but more modern term, implying the sum of scientific knowledge of drugs, which is taken to include their art of preparation—pharmacy, and all that is known of their action—pharmacodynamics, at present usually being restricted to this latter meaning. The subject in its entirety is so broad and comprehensive as to justify subdivisions—some receiving distinctive names.

1. *Pharmacy* (Gr. *φαρμακεία*, the use of drugs): comprising the art of preparing drugs in suitable forms for dispensing, administering, or applying, and includes an acquaintance with much of materia medica, practical and theoretical chemistry, and many manipulations peculiar to itself.

2. *Pharmacognosy* (Gr. *φάρμακον*, a drug, + *γνῶσις*, knowledge): comprising the study of physical and chemical characters of drugs—the knowledge of selecting, recognizing, and identifying true and false specimens by such characteristics.

3. *Pharmacodynamics* (Gr. *φάρμακον*, a drug, + *δύναμις*, power): comprising the knowledge of physiological action—power or strength of remedial agents on living organisms of man or lower animals during health.

4. *Toxicology* (Gr. τοξικόν, poison, + λόγος, discourse): comprising the effect, nature, and detection of drugs when given in poisonous doses—the treatment and antidotes for same.

5. *Therapeutics* (Gr. θεραπεύειν, to cure): comprising the intelligent application or use of agents to cure disease—how they act on living organisms during sickness: (*a*) *rational*, when based upon known laws of the remedies and diseases, as gained through pathology, physiology, and pharmacodynamics, thereby giving the only scientific treatment; (*b*) *empirical*, when based solely upon clinical observation and experience—the employment of a remedy in any pronounced disease, from its valuable service in previous similar cases; (*c*) *general*, where other than drugs or medicines are used for curative purposes: 1. Hygienic agents—cleanliness, pure air, ventilation, proper food and clothing, rest, etc.; 2. Mechanical agents (semi-surgical)—bleeding, leeches, cups, scarifications, issues, setons, frictions, massage, osteopathy, aspiration, acupuncture, gastric lavage, stomach-pump, sprays, syringes, catheters, bed-pans, urinals, hot-water bags, trusses, pessaries, suspensories, bandages, rubber stockings, jackets, thermometers, etc.; 3. Physical agents—*Heat:* solar, artificial (dry or moist vapor), baths—tepid, 29–35° C. (85–95° F.), warm, 35–38° C. (95–100° F.), hot, 38–41° C. (100–106° F.), Turkish, 35–71° C. (95–160° F.), hip or sitz, hot wet-pack; *Cold:* plunge or shower bath, 4–15° C. (40–60° F.), cold wet-pack, rubbing wet-pack, 4–21° C. (40–70° F.), sponging, ice-bag, compresses, douches; *Light:* although at times contraindicated, acts usually as a stimulant or tonic to the blood—correcting imperfect nutrition and imparting strength to organs; *Darkness:* on the other hand, acts as a sedative or tranquillizing agent; *Air:* pure, impure, compressed, hot, 93–149–204° C. (100–300–400° F.); *Electricity:* continuous (galvanic) and induced (faradic) currents, static (frictional) by electric bath, spark, Leyden-jar shock, brush.

Upon the general subject of materia medica, and each of these subdivisions, there are very many published works, but only pharmacy has what may be termed a standard code for reference.

The *Pharmacopœia*, U. S. P. (Gr. φάρμακον, a drug, + ποιεῖν, to make), is such a standard for us, and other countries each have, in a measure, their own. In this volume the most important and reliable drugs with their preparations are enumerated—the list being changed, more or less, in conformity with scientific progress, at each decennial edition.

The *Dispensatories*, several in number, are reference-works—in fact, materia medicas of the most liberal form, treating not only of the five departments as previously defined, but exhaustively of all other phases of the various sciences bearing upon each drug, official or non-official. Owing to their scope and reliability, they are regarded by the medical and pharmaceutic professions with scarcely less favor and authority than the Pharmacopœia.

Forms in which Medicines may be Used.

In early times the crude drugs usually were administered, but some being insoluble, nauseous, irritating, bulky, and ill-suited for either internal or external application, led to the adoption of other forms, such as decoctions, infusions, juices, powders, pills, ointments, etc. At the present day elegant pharmacy has placed us in possession of additional and still more acceptable forms and shapes, the most important here being enumerated.

I. Official (liquids, semi-solids, and solids).

1. *Acetum, Aceta* (vinegars).—10 p. c. Macerate with diluted acetic acid, filter: Scillæ.

2. *Aqua, Aquæ Aromaticæ* (aromatic waters).—Distilled water impregnated, often saturated, with a volatile substance, by (*a*) *trituration*—volatile oil .2 p. c., purified talc 1.5 p. c., water 100 p. c.; may shake frequently together simply the oil and water, or may replace purified talc by purified silicious earth, or pulped filter paper; Anisi, Menthæ Viridis; (*b*) *solution:* Amygdalæ Amaræ, Rosæ; (*c*) *aëration:* Ammoniæ, Ammoniæ Fortior; (*d*) *distillation:* Aurantii Florum Fortior, Rosæ Fortior.

3. *Ceratum, Cerata* (cerates, L. *cera,* wax).—Unctuous-like ointments made firmer by the addition of wax; soften but do not melt at body-temperature; liquefy only above 40° C. (104° F.): Camphoræ, Resinæ.

4. *Collodium, Collodia* (collodions).—Collodion impregnated with medicinal substances for protection and medical effect: Cantharidatum, Flexile.

5. *Decoctum, Decocta* (decoctions, L. *decoquere,* to boil down).—5 p. c. aqueous solutions of vegetable drugs made by boiling the substance about 15 minutes in a closely-covered vessel, allowing to cool therein, expressing, straining expressed liquid, adding through strainer water q. s.; the strength of decoctions of energetic or powerful substances should be directed specially by the physician.

6. *Elixir, Elixira* (elixirs, Ar. *el-ik'sir,* the philosopher's stone).—Sweet, aromatic, hydro-alcoholic, medicated liquids; alcoholic strength 20–25 p. c.: Aromaticum, Glycyrrhizæ.

7. *Emplastrum, Emplastra* (plasters, Gr. εμπλάσσειν, to daub on).—Substances fused in such proportions as to adhere at body-temperature; some are spread, others are not: Belladonnæ, Sinapis.

8. *Emulsum, Emulsa* (emulsions, L. *emulgere,* to milk out).—Aqueous, milky-like mixtures of oils, fats, or resins in a minutely subdivided state, suspended by mucilaginous materials; coagulated by acids, metallic salts, or spirituous liquids in large quantities: Amygdalæ, Olei Terebinthinæ.

9. *Extractum, Extracta* (extracts, L. *ex,* out, + *trahere,* to draw).—Solid or semi-solid, made by evaporating medicinal solutions, or expressed juices of organic drugs, until representing 4–5 times the strength of the crude substances; these may be aqueous, alcoholic, hydro-alcoholic, acetous: Aconiti, Viburni Prunifolii.

10. *Fluidextractum, Fluidextracta* (fluidextracts).—Solutions of organic drugs evaporated until 1 Ml. (Cc.) represents the activity of 1 Gm. of crude drug: Aconiti, Zingiberis.

11. *Glyceritum, Glycerita* (glycerites, Gr. γλυκύς, sweet).—Solutions of a drug in glycerin for external use: Acidi Tannici, Phenolis.

12. *Infusum, Infusa* (infusions, L. *infundere*, a watering).—5 p. c. aqueous solutions of vegetable drugs made by adding to the substance usually boiling water in a closely-covered vessel, allowing to cool therein, straining with expression, passing through strainer water q. s. 100 Ml. (Cc.); if activity of infusion (drug) is affected by heat, cold water should be used; the strength of infusions of energetic or powerful substances should be directed specially by the physician: Digitalis, Sennæ Compositum.

13. *Linimentum, Linimenta* (liniments, L. *linere*, to smear).—Medicinal liquids, containing usually a fixed or volatile oil, for external use by rubbing or by simple application: Ammoniæ, Terebinthinæ.

14. *Liquors, Liquores* (liquors, L. *liquor, liquere*, fluid, liquid).—Mostly aqueous solutions of non-volatile chemical substances: Acidi Arsenosi, Zinci Chloridi.

15. *Magma, Magmas* (L. fr. Gr. μάγμα, μάσσειν, to squeeze, knead).—A thin paste or mixture—a precipitate (hydroxide, etc.) tenaciously retaining liquid (water, alcohol) often removed only by forcible expression; usually white unless fluid contains iron, organic matter, etc.: Bismuthi, Magnesii.

16. *Massa, Massæ* (masses, Gr. μάσσειν, to knead).—Pill-masses preserved in bulk to be used from when required: Ferri Carbonatis, Hydrargyri.

17. *Mel, Mella, Mellita* (honeys, Gr. μέλι, honey).—Medicines mixed with clarified honey instead of syrup: Depuratum, Rosæ. *Oxymella, Oxymellita*—honey 80, acetic acid 10, water 10; to disguise nauseous medicines.

18. *Mistura, Misturæ* (mixtures, L. *miscere*, to mix).—Liquids of insoluble medicines suspended in water by some viscid substance, or solutions of one or more active liquids: Cretæ, Glycyrrhizæ Composita.

19. *Mucilago, Mucilagines* (mucilages, L. *mucere*, to be mouldy, slimy).—Saturated aqueous adhesive liquids of gum or starch: Acaciæ, Tragacanthæ.

20. *Oleatum, Oleata* (oleates, L. *olea*, Gr. ἐλαία, olive tree, oil).—Solutions of medicines (alkaloids or metallic salts) in oleic acid: Hydrargyri.

21. *Oleoresina, Oleoresinæ* (oleoresins, L. *oleum*, oil, + *resina*, resin).—Natural solutions of resin in volatile oils, extracted by ether, acetone, or alcohol: Aspidii, Zingiberis.

22. *Oleum, Olea* (oils, L. *oleum*, Gr. ἔλαιω, oil).—Liquid active constituents, obtained by (*a*) *distillation:* Anisi, Thymi; (*b*) *expression:* Aurantii, Tiglii. *Olea Infusa, Infused Oils.*—Vegetable drug, 10 p. c.; macerate six hours in alcohol (10), ammonia water (.2), + sesame oil (100), heat, stir, strain, filter.

23. *Pilula, Pilulæ* (pills, L. *pilula*, a little ball, dim. of *pila*, a ball. Eng. abbr., *pil.*, pl. *pill*).—Spherical or oval masses of medicine held together by some adhesive substance: Aloes, Rhei Compositæ.

24. *Pulvis, Pulveres* (powders, L. *pulverare*, to powder).—Finely powdered drug or drugs, with or without a diluent, as milk-sugar: Aromaticus, Rhei Compositus.

25. *Resina, Resinæ* (resins, L.; Gr. ρητίνη, resin (of the pine)).—Resinous powders obtained by exhausting the vegetable drug with alcohol, and precipitating the tincture by adding water; they contain all the principles soluble in alcohol and insoluble in water: Jalapæ, Scammoniæ.

26. *Spiritus, Spiritus* (spirit, spirits, L. *spirare*, to breathe, exhale).—Alcoholic or hydro-alcoholic solutions of volatile medicinal substances (chiefly volatile oils): Ætheris, Menthæ Viridis. Also called, when 10 p. c. (England, 10–20 p. c.), *Essences* (*Essentiæ*).

27. *Suppositorium, Suppositoria* (supporitories, L. *supponere*, to place underneath).—Solids of suitable form, cone-shaped, pencil-shaped, globular, oviform, weighing 10–60 gr. (.6–4 Gm.), containing medicines, which melt when inserted into the rectum, nares, urethra, or vagina, the vehicles being oil of theobroma, glycerinated gelatin, sodium stearate: Glycerini.

28. *Syrupus, Syrupi* (syrups, Ar. *shurab*, a drink, beverage).—Concentrated solutions of sugar, the menstruum being an aqueous solution of either medicinal or flavoring agents (simple syrup menstr. plain water): Acaciæ, Zingiberis. *Cordial* (*Cordiale*)—one-fourth weaker medicated syrup.

29. *Tinctura, Tincturæ* (tinctures, L. *tingere*, to dye).—Alcoholic or hydro-alcoholic solutions of non-volatile (except iodine) drug-constituents: Aconiti, Zingiberis. *Tincturæ Medicamentorum Recentium*, 50 p. c.; macerate herb 50 Gm. with alcohol 100 Ml. (Cc.), in a closed vessel, in a moderately warm place, for 14 days, occasionally stirring, strongly express, filter. *Tincturæ Æthereæ*, 10 p. c. (drug), + ether 1, alcohol 2 vols.

30. *Trituratio, Triturationes* (triturations, L. *triturare*, triturated).—Fine powders of medicinal substances 10 Gm., triturated intimately with sugar of milk 90 Gm., added gradually and mixed thoroughly: Elaterini.

31. *Trochiscus, Trochisci* (troches, Gr. τροχίσκος, a pill, troche).—Solid, round, oval, or flat masses of one or more medicinal agents, with sugar or extract of licorice, or both, caused to adhere by mucilage, often flavored: Acidi Tannici, Sodii Bicarbonatis. Also called *Lozenges, Tablets* (*Tabellæ*), in England of definite weight and chocolate base, *Pastilles* (*Pastilli–us*), in England with glyco-gelatin base.

32. *Unguentum, Unguenta* (ointments, L. *unguere*, to smear, anoint).—Soft or solid fatty preparations, for external use, liquefying when rubbed upon the skin, and containing medicine in a basis of lard, benzoinated lard, olive, almond, or lard oil, prepared suet, wax, spermaceti, or paraffin: Acidi Borici, Zinci Oxidi.

II. NON-OFFICIAL.

1. *Abstracts, Abstracta*.—Powders having twice the strength of the vegetable substance, made by exhausting crude drugs, as a rule, with alcohol, recovering same, and incorporating residue with milk-sugar.

2. *Ampul, Ampuls* (Fr. *ampoule*, fr. L. *ampula*, a vase, flask).—Glass vessels (tubes with attenuated end or ends) of varying size con-

taining sterilized liquids for hypodermic, intravenous or inhalation purposes; contents released by breaking off narrow end, or crushing in handkerchief when for inhalation; pearls, tears, or sealed bulbs (amyl nitrite, ethyl chloride, nitrous ether, etc.) are modified ampuls.

3. *Acetic Fluidextracts, Fluidextracta Acetica.*—Solutions of the active constituents of organic drugs made with diluted acetic acid, and of the same strength as the official fluidextracts.

4. *Bougies, Pencils.*—Small solid cylinders of gelatin, glyco-gelatin mass (white gelatin 3, glycerin 1), or cacao-butter, impregnated with medicine, to be inserted into urethra, vagina, rectum, or nares.

5. *Cachets* (*de pain*), *Konseals, Wafers.*—Various-sized concave wafers made of unleavened bread (flour and water) or wafer-paper—the cavity formed by moistening the concave edges of two and pressing together is to contain the drug; when fastened, take by floating in a gulp of water.

6. *Capsules, Capsulæ.*—Various-sized, transparent casings (short tubes, usually with one open end fitting over that of another), of gelatin, hard or soft, for administering nauseous or disagreeable liquids or solids.

7. *Cataplasma, Cataplasmata* (cataplasms, poultices, Gr. *καταπλάσσειν*, to spread over).—Soft pasty masses to supply moisture and warmth locally in order to break down inflamed tissues; flaxseed meal, slippery elm, hops, bread and milk, kaolin and glycerin, bran, oatmeal, etc., answer well for these, to which either tincture of opium, aconite, arnica, or anodyne alkaloid may be added to lessen pain. The true poultice should be made by bringing the moistened mass to a boil, enclosing in a cheese-cloth bag, and applying one-half to one inch thick over inflamed area; the addition of a little fixed oil or glycerin serves to retain heat and prevent caking, while a covering of oiled silk retains these properties much longer—kaolini.

8. *Charta, Chartæ* (papers).—Papers coated or saturated with some medicinal substance, to be used as a plaster or for burning—potassii nitratis, sinapis.

9. *Cigarettes.*—Have paper wrapper but filler of one or more medicinal substances—cubeb, stramonium, etc.

10. *Collyrium, Collyria, Eye-washes.*—Liquid applications for the eyes, composed usually of some astringent salt dissolved in rose water.

11. *Confectio, Confectiones* (confections, boluses, L. *conficere*, to put together).—Pasty masses of drugs triturated with sugar or honey—rosæ, sennæ.

12. *Enemas, Enemata, Clysters.*—Liquids to be injected into the rectum. When large quantity (℥xvj–32; .5–1 L.), it is to act mechanically in emptying the bowel, and warm soapy or mucilaginous water answers the purpose; when small quantity (℥ij–4; 60–120 Ml. (Cc.)), it is to act as a medicine or nutrient, and after injection a towel pressed against the anus tends to aid retention, therefore absorption.

13. *Fluidglycerates, Fluidglycerita–um.*—100 p. c.; glycerin 50 p. c.; menstruum: glycerin 50, dist. water 150, chloroform water q. s., reserve first 50, evaporate second percolate, mix.

14. *Fomentations, Fomenta.*—Flannels wrung out of hot water and applied with or without medication.

15. *Gargles, Gargarisma, Gargarismata.*—Aqueous medicinal liquids for gargling the throat.

16. *Gauzes, Carbasi; Mulls, Mullæ.*—Gauze-muslin saturated with a medicated solution of a definite strength, and then spread horizontally to dry; hard ointments spread on "mull" or soft muslin similar to plasters.

17. *Glycerogelatins, Glycerogelatina–um.*—10 p. c. medicaments, soft masses melting at body temperature, containing glycerin 15–25–35 p. c., dist. water 35–65.

18. *Hypodermic Injections, Injectiones Hypodermicæ.*—Usually aqueous solutions of vegetable drugs or alkaloids, 1–5–10–33 p. c.; sometimes a very small amount of either phenol, cresol, benzoic, hydrochloric, or salicylic acid is added as a preservative.

19. *Inhalations, Inhalationes, Vapors, Vapores.*—Volatile liquid vapors breathed at ordinary inhalation, to act locally upon the respiratory mucous membrane.

20. *Injections, Injectiones.*—Usually aqueous solutions of drugs to be injected by a syringe into the rectum (enemas), under the skin (hypodermic), or into the urethral, nasal, aural, or vaginal tract.

21. *Insufflations, Insufflationes.*—Fine powders of active medicine, and mostly bland bases, to be blown into nares, larynx, throat, etc.

22. *Lotions, Lotiones (Lotio).*—Mostly weak, aqueous medicinal solutions, to be applied locally on linen, lint, or muslin.

23. *Parvules, Granules, Dosi-metric Parvules.*—Very small pills, usually sugar-coated and containing poisonous alkaloids or chemicals.

24. *Pastes; Pastæ Dermatologicæ, Stile Dilubiles; Inunctum.*—Name applied to all ointments; antiseptic or astringent agents made into a paste with either glycerin, soft soap, petrolatum, lard, etc.; medicines made into a paste with starch, dextrin, tragacanth, sugar, water, rolled into cylinders, dried—for dermatologic practice; medicated ointment —85–95 p. c. of hydrous wool fat.

25. *Petroxolins, Petroxolina–um.*—Solutions or mixtures of medicinal agents, 3–50 p. c., in liquid petroxolin.

26. *Scales, Lamellæ.*—Thin scales, disks, or plates of medicinal substances; in England restricted to gelatin and glycerin, to be dropped into the eye, each weighing $\frac{1}{50}$ gr. (.0013 Gm.).

27. *Species.*—The medicinal part of several species of plants mixed, cut, bruised, or reduced to coarse powder, sometimes including a chemical, for external or internal use.

28. *Sprays, Nebulæ.*—Usually aqueous medicinal solutions, to be used in atomizers, for throat, etc.

29. *Succus, Succi, Juices.*—Vegetable liquids expressed and preserved with alcohol.

30. *Tablets, Compressed Tablets, Tabellæ.*—These consist of the pure or diluted drug, made to cohere by heavy compression in strong metallic molds.

31. *Tablet Triturates.*—These consist of the drug along with milk-sugar or cane-sugar, made into a pasty mass with either alcohol, water,

or syrup in some proportion, then pressed lightly into suitable molds and dried. *Dragée* (dra-zha) is the name given in France to the ordinary sugar-coated pill. *Enteric Pills* (Gr. ἔντερον, intestine), such as are coated with a substance, as salol, keratin, etc., to allow passage through the stomach intact, thereby not becoming dissolved until the duodenum or intestinal tract is reached. *Concentric Pills* are made of concentric layers of different ingredients to become dissolved and active at various points of the intestinal tract.

32. *Vinum, Vina* (wines, L. *vinum*, wine).—Liquids differing from tinctures in being extracted with white wine, or a mixture of white wine and alcohol (20–25 p. c.)—antimony, opium.

THE AVENUES BY AND THROUGH WHICH MEDICINES ENTER THE SYSTEM.

1. *By Stomach: Gastro-intestinal Route.*—This is the most common and convenient method. After medicines are swallowed they enter circulation through the walls of the bloodvessels (which permeate the mucous membrane of the stomach and intestines), portal veins, and lacteals, so that when the intestinal contents reach the ileo-cæcal valve they consist of excrementitious matter and food refuse. If the stomach be healthy and empty, crystalloids in solution quickly pass through the vessel-walls, but colloids (albumin, fats, gelatin, gums, etc.) have to be digested and emulsified before they can be absorbed; the albuminous drugs (proteids) are transformed in the stomach by pepsin and gastric juice into soluble peptones, and there as such these, along with soluble crystalline salts, diffuse readily into the blood, often giving positive effect within an hour; the sugar, starchy, fatty, gummy, gelatinous, resinous, gumresinous and oleoresinous drugs, without suffering much change from the stomach secretions, pass into the duodenum, where the bile, intestinal and pancreatic juices, within 3–4 hours, convert the starches into sugar (which in part may go finally into lactic acid and fat), emulsionize and saponify the fats, oils, etc., separating them into glycerin and fat acids, the latter meeting alkaline bases, forming diffusible soaps; the resins, alone and in combination, within 4–10 hours, become broken up by these same alkaline juices (associated alkaline salts often facilitating), and either are converted into a soluble form for systemic ingestion, or simply are eliminated from the liver [whose secretion (bile) they have stimulated], thereby being allowed to pass into the lower intestine to stimulate intestinal gland secretion, or to act somewhere along the tract as a local irritant or stimulant, thereby aiding peristalsis. All drugs taken from the intestinal canal have to pass through the liver before reaching general circulation, and in this passage they may become medicinally very much changed, modified, or even destroyed; again, some drugs may be excreted into the intestine along with the bile, and never reach further circulation, hence these disadvantages, along with that of required palatable form, preclude sometimes the adoption of this avenue.

2. *By Skin:*
   1. *Hypodermic* (*Hypodermatic*).—This consists in injecting medicinal solutions (♏v–15; .3–1 Ml. (Cc.)) into subcutaneous areolar tissue with a syringe (needle)—a method always more or less painful. Quick absorption here takes place by the lymphatics and capillary vessels, giving the advantage of full action of the quantity of drug used, without any possible changes from the intestinal secretions or processes; must here employ only clear, neutral (never acid), aqueous solutions of drugs, as otherwise intractable sores, sloughing, etc., might result around the punctures; must also avoid veins, injecting only on the external parts of the legs, thighs, arms, also abdomen, back, and buttocks (4 Cm.; $1\frac{3}{5}'$ behind the great trochanter). In the process of *hypodermoclysis* a sterilized trocar is employed, and several pints of saline solution ($\frac{7}{10}$–1 p. c.) injected, to antagonize, or to wash out and dilute any septic poison (uræmia, septicæmia) cholera-collapse, diabetic coma, shock, etc.; here insert trocar in subcutaneous tissue of abdomen or thigh, and control rate of flow alone by elevating or lowering the vessel containing the required amount of liquid; dissipate any tumefaction by careful massage; admit no air or foreign matters.
   2. *Epidermic* (*Epidermatic*).—Here medicines are incorporated in wool fat, or other fats, and rubbed with friction directly upon the skin, thus promoting their passage through and between epidermal cells; best to apply where skin is thinnest (axillæ, groins, abdomen, insides of thighs) in the form of ointments, oleates, or oils. This method also is called *inunction*.
   3. *Enepidermic* (*Enepidermatic*).—Here medicines are applied to the skin without friction; chloroformic and oleic acid solutions of the alkaloids (aconitine, atropine, morphine, strychnine) pass by osmosis most easily; solutions in a mixture of chloroform and alcohol nearly as fast; aqueous solutions slower, while pure alcohol causes an outward osmotic flow. In this way medicinal effect is secured through plasters and poultices.
   4. *Endermic* (*Endermatic*).—Here we first produce a blister on the skin by the use of strong ammonia water (saturated cloths) or cantharides (cerate, collodion), then remove with scissors the epidermis, and apply upon the denuded surface (derma) the powdered medicine—morphine, atropine, quinine, strychnine, etc.; at present little employed.

3. *By Rectum.*—This is accomplished by enemas or suppositories, being suited best to disagreeable tasting alkaloids, acid solutions, etc. While absorption is usually twice as slow by this method as by the stomach, yet salts of atropine and morphine in solution enter circulation just as quickly, while those of strychnine more quickly than even by the mouth.

4. *By Lungs: Respiration.*—Vapors of liquids or solids are inhaled with the air, thereby bringing the system quickly under the drug's

influence; this quick action is due to the rapid absorption, owing to the extensive surface (lungs, etc.) to which applied, and to the fact that volatile substances penetrate the tissues most readily. Some vaporize at all ordinary temperatures, others at that of the body, while many have to be heated. Most anæsthetics act by this method.

5. *By Arteries: Arterial Transfusion.*—Large quantities of fluid (defibrinated human or lamb's blood—℥iv–8; 120–240 Ml. (Cc.), etc.) may be introduced into circulation, through the radial or posterior tibial, by the transfusion syringe. This is safer than by the veins, owing to the less likelihood of admitting air (causing fatal syncope) or of producing thrombosis, as the injected solution has to traverse the capillaries prior to reaching the right side of the heart, thus avoiding any likely sudden distention.

6. *By Veins: Intravenous Injection.*—This is the most perilous of all methods, being resorted to only in extreme emergencies to save life; thus blood or milk in hemorrhage, epilepsy, uræmia, cholera-collapse; saline solutions in cholera-collapse, diabetic coma; diluted ammonia water, ether, brandy or whisky in bites of reptiles, venomous insects, hydrocyanic-acid poisoning, opium-narcosis, chloroform-asphyxia. It is better here to inject into a vein of the leg than of the arm, so that the drug may be less concentrated when it reaches the heart, thereby avoiding possibly any cardiac depression.

7. *By External Application.*—Many powdered medicines when dusted on abraded surfaces, or applied by insufflation to the nares, fauces, larynx, become absorbed gradually, and affect the system locally and generally; this equally applies to drops and washes when introduced into the eyes and ears, also to atomized vapors, sprays, etc. The method known as *cataphoresis* consists of producing osmosis, through the skin or mucous membrane, from one point to another, of medicines by the galvanic current, the positive pole being medicated and placed over the affected part, the negative slightly remote; this is a mechanical action, and is accomplished by covering the seat of pain with a paper, linen, or gelatinous disk moistened with a solution of the drug, and placing thereon the anode, or may apply direct the sponge electrode saturated with the medicine; this method affects only tissues between the poles, and solutions of aconite, chloroform, cocaine, and morphine yield good results.

The Means by which Medicines are Transmitted through the System.

It was believed for a long time that drugs radiated from the seat of application throughout the system, by the nerves; this is known now to be false, and, instead, we recognize the blood to be the common carrier; thus the blood has to take up the drug in solution before there will be other than a local effect, and when once dissolved in it the periodic rounds of circulation are made regularly with this impregnation, so that the system, as a whole, responds to the medicine's influence. As proof of this, we find that blood taken from any portion of the body, near or far from the point of application, contains the drug; also the blood of persons poisoned when injected into others produces similar poisonous symptoms; if you interrupt the blood-circulation to any part, no poison will be transmitted to that part; as other secretions are nourished by the blood, you would expect them also to have similar medical properties, and such is the case—milk, sweat, urine, etc.; if we inject medicines directly into the blood (a dangerous process), we soon have characteristic action. The blood is enabled to absorb these through the intervention of the veins, lymphatics, and lacteals; while it eliminates them, even to the extent often of irritation, through the excretory organs, kidneys, bowels, skin, etc.

Conditions which may Modify the Action—Hence the Dose of Drugs.

Medicines are not given immediately before or after meals, unless certain conditions urgently demand it; they enter circulation much quicker on an empty stomach and then also produce best local results, whereas a full stomach not only retards absorption, but renders poisons and irritating chemicals less injurious. The system is most resistent in the morning, when larger quantities of hypnotics, etc., are required than at night. The interval of doses depends upon rate of absorption and elimination of each drug, and usually should be sufficiently brief as to prevent the patient coming from under a continued influence until finally desired. Medicines change or modify directly the action only of those organs and tissues with which they come into immediate contact; this action may be simply local, or again general (systemic), and while all have one primary (direct) action, they may also produce indirectly (reflexly) one or more secondary (remote) effects.

The identical drug does not give rise to like results in every person, nor do different specimens of the same drug, when taken in equal quantities, produce the precise effects upon the one individual; for this there are several causes:

1. *Age.*—While the adult dose is about uniform (being based upon the average weight of 150 pounds; 68 Kg.), and holds good between the ages of twenty to sixty, yet that from infancy to majority is variable, and should be computed by the following rules: Dr. Cowling's applies to any age up to and including the twenty-fourth year, and is thus: Divide the age at the next birthday by 24, and that fraction of the adult dose gives the quantity sought—child one year at coming birthday = $\frac{1}{24}$ of adult dose; gentian, gr. 30, hence $\frac{1}{24}$ of 30 = gr. $1\frac{1}{4}$. Dr. Young's applies to any age up to twelve years, and is thus: Divide the age at the coming birthday by that age plus 12—child two years at next birthday $= \frac{2}{2+12} = \frac{2}{14} = \frac{1}{7}$ of adult dose; cinchona, gr. 40, hence $\frac{1}{7}$ of 40 = gr. $5\frac{5}{7}$. Dr. Brunton's applies to metric doses, and is thus: Multiply the adult quantity by the approaching birthday, and that again by 4, then remove the decimal point two places to the left; adult dose of catechu is 1 Gm., and for a child five years old at its next birthday $= \frac{1. \times 5 \times 4}{100} = .2$ Gm.

Very old persons are extremely susceptible to strong or even ordinary medication, all doses having usually to be diminished. Children are very acute to opium and many anodynes, yet tolerate larger quantities of purgatives and a few other drugs (castor oil, calomel, rhubarb, codliver oil, iron, belladonna, ipecac, pilocarpine, squill, arsenic, hydrated chloral) than the rules would indicate.

2. *Mode of Administration.*—This has much to do with the rate of absorption, hence controls largely the dose. Thus the dose hypodermically is one-half that by the mouth, or one-fourth that by the rectum, and this difference depends upon the rapidity of absorption—the hypodermic being the quickest, the rectum the slowest; on a full stomach, medicines enter circulation much slower than on an empty one.

3. *Form of the Drug.*—This controls largely the rate of absorption, hence, the dosage. Before any substance enters circulation it must be in solution, and the nearer medicines approach the liquid form the quicker will they have effect and the smaller will be the doses required, consequently, it takes less in tincture than in powder or pill form.

4. *Condition of the Drug.*—The same species do not always produce drugs of uniform strength; thus cinchona, opium, nux vomica, rhubarb, senna, etc., are by no means regular, as the total alkaloids of cinchona may range from 2–10 p. c.; opium, 4–24 p. c., etc.; therefore, to have like results varying quantities must be given. This strength-difference is due largely to soil, climate, cultivation, season of year when collected, curing, duration on the market, possible adulterations, etc.

5. *Conditions of the Individual.*—These are not always the same; sex, race, temperament, idiosyncrasy, congenital tolerance, acquired tolerance (mithridatism), climate, occupation, imagination, mental emotion, disease, and habitual use all affect the dosage required in individual cases. Thus, females demand less than males; strong, burly races more than weaker ones; sanguine temperaments cannot tolerate stimulants; nervous temperaments must use purgatives cautiously; bilious temperaments need mercurials, while these are injurious to lymphatic temperaments. Idiosyncrasies vary in people—some vomit at the odor of ipecac or purge by smelling croton oil; others are affected little or greatly by opium, mercury, arsenic, belladonna, cocaine, iodides, etc. Warm climates demand smaller doses of purgatives and larger doses of antiperiodics. Occupation largely controls doses, as those exposed and under hard labor require unlike quantities to those in light pursuits, sedentary habits, indoor surroundings, etc. Imagination has its effect, as in a degree one's frame of mind can will or not will results. Mental emotion, either with or without disease, as a rule, demands larger doses than when free from any undue excitement. Habitual use lessens medicinal power, the dose having to be increased gradually, as with cathartics, opium, arsenic, etc. Disease modifies dose, as in tetanus, peritonitis, cancer, cholera, etc., excessive quantities of morphine are required and well tolerated; in typhoid fever abnormal amount of stimulants may be used, as alcohol, brandy, etc.; in pneumonia excessive doses of tartar emetic may be given without nausea,

while during menstruation, lactation, pregnancy, etc., smaller doses should be administered.

6. *Incidental Conditions.*—Besides the preceding, we have some other factors influencing the variability of doses: State of the stomach, empty, full, active, sluggish, etc.—under certain disorders it will not assimilate medicines at all, when administration must be by other channels. Cumulative action of some drugs requires cautious doses; this may arise from slower elimination than absorption—mercury, lead; or the elimination may suddenly be arrested by the drug causing contraction of renal vessels, when the system has become saturated—digitalis, strychnine; or again, the intestinal contents may quickly be changed, so that from a slow we get rapid absorption; rate of excretion modifies doses—when rapid, small and oft-repeated quantities are more advantageous than larger ones, and as an outgrowth of this we have now the praiseworthy tendency of diminished dosage, as with calomel, etc.; pathological conditions modify the effects of drugs very considerably; thus antipyretics in fever reduce temperature, but have no effect on it in health; bromides lessen convulsions in epilepsy, but depress very slightly the normal brain, etc.

7. *Untoward Effects.*—Many drugs produce other than their accustomed action upon certain individuals, made abnormal through habit or inheritance; such action results not from any drug impurity, but rather from the difference in the drug's primary and secondary effects (often opposite), the organs chiefly affected by the ordinary action of the drug, and the method of drug elimination. Thus an antipyretic, reducing temperature through the skin (this being connected with and controlled by the central nervous system regulating temperature), may produce skin eruptions or excessive perspiration (untoward)—the drug being eliminated by this channel; and as temperature cannot be controlled without, at the same time, controlling the vasomotor system regulating the blood supply, we also may have collapse, heart failure, palpitation, eye and ear symptoms. If drug is eliminated by kidneys we may have albuminuria, etc. (untoward); hypnotics acting on central nervous system may produce perspiration, skin eruptions, vertigo, heart collapse (untoward); astringents may occasion diarrhœa, bloody intestinal discharges (untoward); diaphoretics from over-stimulation cause local pain, etc. (untoward). Thus aconite may produce eruption or itching of the skin; antipyrine—cyanotic hands, nose, lips, cold extremities; arsenic—dermatitis, burning of the skin, coryza; caffeine—insomnia, delirium, tremors, palpitation, tinnitus aurium, gastralgia; hydrated chloral—nausea, vomiting, purging, inflamed eyes; digitalis—nausea, indigestion, syncope; potassium iodide—coryza, acne; iron—gastric disturbance, headache, constipation; opium—wakefulness, nausea, vomiting, mental depression; pilocarpus—dim vision, vomiting, collapse, swollen salivary glands and tonsils, hiccough, strangling; salicylic acid—headache, tinnitus aurium, acne, blindness; cinchona—cinchonism, etc. Powerful drugs (tonics, alteratives, etc.), far more than those comparatively inert, tax the inherited and acquired defi-

ciencies, while excessive and continuous strain on inhibitions usually produce affections of inhibitory apparatus as to modify greatly the untoward effects; these so vary in neurotics as often to cause such nerve-strain of eliminative and assimilative organs as to produce toxins, thereby intensifying or diverting drug's action—etiological moment.

8. *Incompatibility.*—This often changes the drug's action, producing harmless or harmful compounds, and may be of three kinds:

1. *Chemical.*—This results from double decomposition, new compounds being formed, and with the prescriber may be intentional or unintentional: from the former we may have lime water with mercuric or mercurous chloride; zinc sulphate in solution with lead acetate; hydrochloric acid directly to potassium chlorate, etc.; in all these the new-formed product is the one desired medicinally; from the latter (unintentional) we may have glucosides (tannin, etc.) ordered with free acids, or emulsions; alkaloids with alkalies, alkaline salts, iodides or bromides; tannic and gallic acids with iron salts, alkaloids, tartar emetic, albumin, metallic oxides, gelatin; vinegars, acetic syrups, and diluted acid solutions with soluble carbonates; quinine sulphate with potassium acetate; corrosive mercuric chloride with alkalies, alkali carbonates, iodides, bromides, alkaloids, sulphides, reduced iron, silver nitrate, albumin, gelatin, tannin, etc. Any of the following with other substances should also be watched carefully, as they readily cause precipitation and changes: Chlorine solutions, corrosive mercuric chloride, iodine, iodides, lead salts, iron solutions, potassium acetate, bromide, and permanganate, solution of potassium hydroxide, tannic and gallic acids, diluted hydrocyanic acid, mineral acids, quinine sulphate, silver and zinc salts, tincture of guaiac, chlorates, iodates, picrates, nitrates, dichromates. The accompanying table is from Potter's *Materia Medica*, and serves an admirable purpose in this connection; P. stands for precipitate.

	Alkaloidal solutions (generally).	Metallic solutions (generally).	Solutions of lead or silver.	Solutions of calcium salts.	Solutions of magnesium salts.	Solutions of albumin or gelatin.
Alkalies	P.	P.	P.	P.	P.	
Tannic acid	P.	P.	P.	. .	. .	P.
Carbonic acid and carbonates	P.	P.	P.	P.	P.	
Sulphuric acid and sulphates	. .	. .	P.	P.		
Phosphoric acid and phosphates	P.	P.	P.	P.	P.	
Boric acid and borates	P.	P.	P.			
Hydrochloric acid and chlorides	. .	. .	P.			
Hydrobromic acid and bromides	. .	. .	P.			
Hydriodic acid and iodides	P.	. .	P.			
Sulphides	. .	P.	P.			
Arsenical preparations	. .	P.	P.			
Albumin	. .	P.	P.			

Explosions have resulted by mixing fluidextract of uva ursi or geranium with spirit of nitrous ether; chromic or nitric acid with glycerin; potassium permanganate with glycerin; silver nitrate with creosote; silver oxide with extract of gentian in pill; potassium chlorate with glycerin and tincture of ferric chloride; calcium chloride triturated with sulphur; oxidizing agents with sulphur, charcoal, iodine, phenol, glycerin, turpentine, etc.; iodine with ammonia; potassium chlorate with catechu. Poisonous compounds result from mixing potassium chlorate with its iodide, forming in the system potassium iodate; potassium chlorate with syrup of iodide of iron, liberating in the system free iodine; diluted hydrocyanic acid or potassium cyanide with calomel, forming corrosive mercuric chloride or mercuric cyanide.

2. *Pharmaceutical.*—This results when substances are mixed and do not produce clear solutions, owing to their different solubility in menstruums—insoluble powders or oil will not mix with water, nor will water with solutions of resins without precipitation—acid quinine solutions with licorice solutions precipitate glycyrrhizin—alcoholic solutions with aqueous solution of hydrated chloral separate the latter on top. In all such cases it is better pharmacy to suspend the separated ingredients by the addition of a mucilage or some emulsifying agent. Under this head it is well to remember the following classes:

1. Alcoholic or resinous tinctures and fluidextracts, essential and fixed oils, copaiba, each precipitate with aqueous preparations.
2. Compound infusion of cinchona with compound infusion of gentian, and this latter with infusion of wild cherry.
3. Spirit of nitrous ether with strong mucilages, tincture of guaiac, solution of potassium bromide or iodide.
4. Alcoholic liquids, tinctures, and fluidextracts with those made with diluted alcohol; also with strong solutions of acacia.
5. Infusions in general with metallic salts—due to gelatinization and behavior of tannic acid.
6. Antipyrine with alkaloids, tincture of odine, corrosive mercuric chloride, Lugol's solution, spirit of nitrous ether, ferric salts, hydrocyanic, tannic, and nitric acids, phenol, permanganates, salicylates, hydrated chloral, orthoform.
7. Pepsin with alkalies, alcoholic liquids, mineral salts, tannates, heat (100° C.; 212° F.).
8. Salicylic acid with iron compounds, alkali iodides, spirit of nitrous ether.

3. *Therapeutical.*—This results where two drugs of opposite medicinal properties are given together—the one neutralizing somewhat the other; astringents with purgatives; aconite or veratrum viride with digitalis; atropine, belladonna, hyoscyamus, or stramonium with caustic alkalies, pilocarpine, physostigmine (eserine), or morphine; acids with alkalies; arsenic with hydrated ferric oxide; phenol or lead salts with magnesium or sodium sulphate; cannabis with strychnine, picrotoxin, or acids; cocaine or gelsemium with morphine; conium with strychnine, picrotoxin, or stimulants; corrosive mercuric chloride with tannin or vegetable astringents; homatropine with physostigmine (eserine); opium and its alkaloids with potassium permanganate, belladonna, hyoscyamus, or stramonium; oxalic acid with calcium carbonate;

silver nitrate with sodium chloride; strychnine or picrotoxin with hydrated chloral and potassium bromide; tartar emetic with tannin. Sometimes physiological antagonists are prescribed together purposely, in order to have the action of the one to guard that of the other, as atropine with morphine (hypodermically).

THE CLASSIFICATIONS OF MEDICINES.

There have been many systems brought forward to facilitate the studying of drugs, and it is owing, possibly, to the number that authors observe little uniformity in the arrangement followed. It has been thought wise to outline the five most important, of which the first and fourth alone are by their nature sufficiently comprehensive to include all organic and inorganic drugs without any omissions. The others (three) are but scientific systems applicable only to the organic medicines, and, as such, are recommended mostly by pharmaceutical and chemical investigators.

I. ARRANGEMENT BY ALPHABETIC SEQUENCE.—This is the least scientific but the most popular; in fact, it is not a true system, as no tacit relationship in any particular exists between the associated subjects, save that of initial letter in spelling, which possibly can offer to the student only the trifling advantage of lexical convenience.

II. ARRANGEMENT BY CHEMICAL CONSTITUENTS.—From a very early period organic drugs (vegetable and animal) were known to yield some of their activity to water and spirit, but the precise nature of the active constituents were little sought after until the beginning of the last century. The intelligent development of chemistry has been the means of separating these potentials and assigning their individual nature, to the extent of formulating a system or an arrangement of plants into groups dependent upon their chief constituent furnishing the medicinal properties, as: alkaloid, glucoside, fixed oil, volatile oil, resin, starch, etc. This classification, although best for the chemist in his laboratory investigation, somewhat assists the botanist, since certain genera and even families (natural orders) occasionally have similar constituents: Labiatæ (volatile oil), Solanaceæ (mydriatic alkaloids), Convolvulaceæ (cathartic resin), etc. Its great drawbacks consist in the variability of the nature assigned these constituents from time to time through the advance of chemical science: thus, a neutral principle today may be an alkaloid tomorrow; and, again, nearly all drugs have more than one constituent, the most abundant often being the least active, and which should govern its classification is not always easy to decide. To the general student, however, it is of considerable value, as it furnishes a knowledge of the character, name, and number of the possible drug constituents, also impresses the great difference between the crude drug and its active principle, and beyond all—that in every case it is the latter that furnishes the drug's working capacity.

1. *Amylaceous.*—Those containing starch as their chief medicinal principle: inula, lappa, cetraria, etc.

2. *Mucilaginous, Gummy.*—Those having considerable mucilage or gum: acacia, tragacanth, flaxseed, etc.

3. *Saccharine.*—Those containing much sugar in some form: manna, glycyrrhiza, triticum, etc.

4. *Acidulous.*—Those containing chiefly an organic acid: lemon, orange, tamarind, rubus, etc.

5. *Oleaginous.*—Those containing: (*a*) Volatile or essential oil: (1) Terpenes, $C_{10}H_{16}$: turpentine, cubeb, juniper, etc. (2) Oxygenated, $C_{10}H_{18}O$: cinnamon, anise, fennel, etc. (3) Sulphurated, $C_{12}H_{22}S_2$: mustard, asafetida, allium. (4) Nitrogenated, C_7H_6O (HCN): bitter almond, wild cherry, peach, etc. (*b*) Fixed oils (Compound ethers) which leave a permanent stain: olive, almond, castor oils, etc.

6. *Resinous.*—Those containing much resin: (*a*) Natural exudations: mastic, guaiac, benzoin. (*b*) Extracted by alcohol, etc., from resinous drugs: podophyllum, jalap, sumbul, etc.

7. *Gumresinous.*—These contain milky exudations consisting of one or more gums and resins: (*a*) With volatile oil: ammoniac, asafetida, myrrh, etc. (*b*) Without volatile oil: gamboge, scammony, etc.

8. *Oleoresinous.*—Those containing a volatile oil holding in solution a resin: turpentine, copaiba, Burgundy pitch, etc.

9. *Balsamic.*—Those containing a liquid, semi-liquid, or solid vegetable product composed of a resin or oleoresin, an odorous principle, and either one or both benzoic and cinnamic acids: Peru, Tolu, storax, etc.

10. *Glucosidal.*—These contain an organic principle converted by mineral acids, alkalies, or ferments into glucose and an allied organic compound; they may be neutral or acid, and sometimes form salts; nearly all are soluble in alcohol: salicin, gentiopicrin, cathartic acid, tannin, etc.

11. *Neutral Principles.*—These, sometimes called bitter principles from their bitterness, are plant-constituents, either neutral or feebly acid, and, when possible, form salts with alkalies; they differ from glucosides in not splitting into glucose, and from alkaloids in not being precipitated by tannin or mercuric-potassium iodide: aloin, elaterin, picrotoxin, santonin, etc.

12. *Alkaloidal.*—These contain alkaloids composed of carbon, hydrogen, and nitrogen alone, if liquid (amines), and additionally oxygen, if solid (amides); sometimes they are called vegetable alkalies, and, in fact, are related to ammonia, as when heated with alkalies ammonia is given off: quinine, morphine, cocaine, atropine, nicotine, coniine, etc.

III. ARRANGEMENT BY MORPHOLOGY AND ANATOMY.—This system is preëminently adapted for those wishing to become perfectly familiar with the general make-up of the various official plant-parts; the inner structural resemblances and differences of each group-member, as well as the relationship that each group itself sustains to its neighbors. In other words, it is most suited to laboratory work where time is afforded to make cross-sections, stainings, tests, dissections of fibrovascular bundles, medullary sheaths, rays, etc., thereby readily distinguishing the true and genuine article from that which is false and spurious.

1. *Roots, Radices:* (*a*) Monocotyledonous: sarsaparilla. (*b*) Dicotyledonous. (1) Fleshy: stillingia, sumbul, calumba. (2) Woody: glycyrrhiza, pareira, krameria, ipecac, etc.

2. *Rhizomes, Rhizomata:* (*a*) Cryptogamous: aspidium. (*b*) Monocotyledonous. (1) Without roots: ginger, calamus, triticum. (2) With roots: veratrum viride, cypripedium, iris. (*c*) Dicotyledonous. (1) Without roots: sanguinaria, geranium, podophyllum. (2) With roots: valerian, arnica, serpentaria, hydrastis, spigelia, etc.

3. *Tubers and Bulbs, Tubera et Bulbi:* (*a*) Monocotyledonous tubers: colchicum, salep, indian turnip. (*b*) Monocotyledonous tunicated bulbs: squill, garlic, etc. (*c*) Dicotyledonous tubers: jalap, aconite, corydalis.

4. *Twigs and Woods, Stipites et Ligna:* (*a*) Twigs: dulcamara, scoparius. (*b*) Woods: quassia, guaiacum, hæmatoxylon, etc.

5. *Barks, Cortices:* (*a*) Bitter and astringent: cinchona, wild cherry, viburnum. (*b*) Astringent: white oak, rubus, pomegranate. (*c*) Bitter, not aromatic: frangula, cascara sagrada, juglans. (*d*) Acrid or pungent: xanthoxylum, mezereum, euonymus. (*e*) Mucilaginous: ulmus. (*f*) Aromatic with oil- or resin-cells: cinnamon, sassafras, cascarilla, etc.

6. *Leaves and Leaflets, Folia et Foliola:* (*a*) Entire. (1) Aromatic, glandular, coriaceous: rosemary, pilocarpus, eucalyptus. (2) Not aromatic, glandular, or coriaceous: uva ursi, senna, coca. (*b*) Toothed or crenate. (1) Coriaceous: chimaphila, buchu, eriodictyon. (2) Not coriaceous: stramonium, hyoscyamus, digitalis, etc.

7. *Herbs, Herbæ:* (*a*) Cryptogamous: chondrus, cetraria, maidenhair, etc. (*b*) Dicotyledonous. (1) Petals distinct: pulsatilla, chelidonium, scoparius. (2) Petals united: eupatorium, lobelia, peppermint (Labiatæ). (3) Petals absent: cannabis.

8. *Leafy Tops, Cacumina Summitates:* savine, red cedar, thuja, etc.

9. *Flowers and Petals, Flores et Petala:* (*a*) Unexpanded: clove, santonica. (*b*) Expanded. (1) Polypetalous: orange, kousso, rose. (2) Gamopetalous: Compositæ, sambucus, lavender, etc.

10. *Fruits, Fructus:* (*a*) Multiple: juniper, hops, fig. (*b*) Simple. (1) Drupes: phytolacca, cubeb, black pepper, prune. (2) Berries: lemon, capsicum, colocynth. (3) Achenes: barley, lappa, cannabis. (4) Cremocarps: Umbelliferæ. (5) Capsules: cassia fistula, cardamom seed, vanilla. (6) Parts of fruit: lemon, tamarind, etc.

11. *Seeds, Semina:* (*a*) Monocotyledonous (albuminous): sabadilla, colchicum, areca, etc. (*b*) Dicotyledonous. (1) Exalbuminous: almond, pumpkin, physostigma, mustard. (2) Albuminous: nux vomica, staphisagria, linseed, nutmeg, stramonium.

12. *Drugs with Cellular Structure:* (*a*) Not farinaceous: nutgall, ergot, mace, saffron, lupulin, lycopodium. (*b*) Farinaceous: starch, tapioca, barley, etc.

13. *Drugs without Cellular Structure:* (*a*) Extracts and inspissated juices, *Extracta et succi inspissati.* (1) Wholly or partially soluble in water or alcohol: guarana, opium, lactucarium, aloes, extract of glycyrrhiza, extract of hæmatoxylon, catechu, gambir, kino. (2) Insoluble in water or alcohol: gutta-percha, elastica, etc. (*b*) Sugars, *Sacchara:* sugar, manna, honey. (*c*) Gums, *Gummata:* acacia, tragacanth, etc. (*d*) Gumresins, *Gummi resinæ.* (1) With volatile oil: asafetida, ammoniac, myrrh. (2) Without volatile oil: gamboge, scammony. (*e*) Resins, *Resinæ.* (1) Without benzoic or cinnamic acid: elaterium, mastic, rosin, guaiac. (2) With benzoic and cinnamic acids: benzoin, dragon's blood. (*f*) Balsams and oleoresins, *Balsama et oleoresinæ.* (1) Without benzoic or cinnamic acid: copaiba, turpentine, Burgundy pitch, tar. (2) With benzoic or cinnamic acid: Peru, Tolu, storax. (*g*) Volatile oils and camphors, *Olea volatilia et camphoræ.* (1) Volatile oils—arranged in sequence of families (natural orders), containing a volatile portion, elæoptene, and a less volatile portion, stearoptene, or camphor: terpenes, oxygenated, nitrogenated, sulphurated. (2) Camphors: camphor, thymol, menthol, etc. (*h*) Fixed oils and waxes, *Olea pinguia et ceræ.* (1) Liquid fats: almond, olive, linseed, codliver, croton, castor oils. (2) Solid fats: oil of theobroma, lard, suet. (3) Waxes: spermaceti, wax.

14. *Drugs of Animal Origin:* (*a*) Animals: cantharides, cochineal, leech. (*b*) Animal products, tissues, secretions: eggs, isinglass, musk, pepsin, ox-gall. (*c*) Calcareous skeletons and concretions: coral, cuttlefish bone, oyster-shell.

IV. ARRANGEMENT BY THERAPEUTIC EFFECT.—This is possibly the least difficult and most useful to the average physician. In a way it is scientific, but since many medicines possess more than one property with the same or varying dosage, it often becomes more or less confusing as to the group to which such should be assigned; then again this system has become somewhat flexible and lacking in perfect uniformity through the preferences of those giving it prior sanction. Thus all drugs may be placed into a dozen general classes, each with many subdivisions: those acting on protoplasm, muscle, nerves, spinal cord, brain, special senses, reproduction, circulation, digestive system, tissue-changes, excretion, generative system; or with no less equity the same number may be retained, but in substance somewhat modified, thus: drugs acting upon organisms, blood, cardiac mechanism, vessels, skin, urinary system, bodily heat, respiration, digestive apparatus, nervous and muscular systems, organs of generation, metabolism; or again the general classes may be omitted, simply using the names descriptive of the various therapeutic effects, arranged alphabetically, or according to real or fancied importance. From its universal favor and the usage of its terms throughout this work, we give yet another modification which has some advantages.

I. Agents Promoting Constructive Metabolism (Metamorphosis).

1. *Restoratives* (L. *restaurare*, to restore).—These restore or renew strength or vitality: (*a*) Foods, Aliments—which maintain some vital process, or renew some structural material, while medicines can modify only some vital action. They are derived from the vegetable, animal, and mineral kingdoms, and in nature are recognized as being either: *oxidizable*—heat-producing and force-forming: carbon compounds, fat, sugar, starch, gum, etc.; *nitrogenous*—flesh-forming: albumin, casein, fibrin, etc.; *unoxidizable* or *incombustible:* metallic salts, water, etc.; (*b*) Digestive ferments—which are animal and vegetable substances for aiding digestion when the normal alimentary secretions are inefficient: pepsin, pancreatin, papain, diastase, ingluvin, etc.; (*c*) Digestive acids—which check the production of glands having acid secretions, but increase those having alkaline secretions: diluted hydrochloric, nitric, sulphuric, nitro-hydrochloric, lactic, phosphoric, etc.; (*d*) Fats and fatty oils—which form the molecular basis of the chyle, are indeed necessary for the digestion of nitrogenous food, and by oxidation become the chief producers of vital force and heat: cod-liver, cottonseed, linseed, olive, sweet almond, theobroma; (*e*) Hæmatics (Gr. ἁιματικός, of the blood)—which increase the amount of hæmatin in the blood, improving its quality by enriching the red corpuscles: salts of iron, manganese, chalybeate waters, etc.; (*f*) Tonics (Gr. τονικός, tone)—which improve the tone of specific tissues, restoring energy and strength to the entire debilitated system, by imperceptibly stimulating vital functions. (1) Mineral: phosphorus, phosphates, phosphites, bismuth, arsenic, etc. (2) Vegetable: (*a*) Simple Stomachic Bitters, containing a bitter principle: gentian, calumba, quassia, chirata, calendula; (*b*) Aromatic Bitters, containing a volatile oil, bitter principle, resin, tannin: serpentaria, wild cherry, eupatorium, anthemis, matricaria.

2. *Antiperiodics* (L. *anti*, opposed to, + *periodicus*, periodic, period).—These prevent recurrence of or modify certain periodic febrile diseases by arresting further development in the blood of successive crops of pathogenic organisms causing the disorder: cinchona alkaloids, eucalyptus, salicin, arsenic, etc.

3. *Antipyretics, Febrifuges* (Gr. ἀντί, against, + πυρετός, fever; L. *febris*, fever, + *fugare*, to put to flight).—These reduce abnormally high body-temperature, either by decreasing heat-production, or increasing heat-loss; the former condition being effected by (1) lessening tissue-change, (2) reducing circulation; the latter by (1) dilating the skin-vessels, thereby increasing radiation, (2) causing perspiration and its evaporation, (3) abstracting body-heat, through cold applications: cinchona alkaloids, acetanilid, antipyrine, phenacetin, salol, phenol, creosote, aconite, veratrum viride, cold bath, pack, or sponging, purgation, venesection.

4. *Antiphlogistics* (Gr. ἀντί, against, + φλογιστός, burning).—These reduce inflammation of serous membranes: mercury, opium, etc.; respiratory tract and organs: aconite, tartar emetic, etc.; and puerperal metritis; veratrum viride, ergot, cold, purgation, etc.

II. Agents Promoting Destructive Metabolism (Metamorphosis)—Increase Waste.

5. *Semi-alteratives, Alkalies.*—These, before meals, stimulate acid and check alkaline secretions when placed in contact with the mouths of the gland-ducts producing them; when administered after meals, they may be (1) Direct—which lessen the stomach's acidity. (2) Indirect—which have only a remote effect, being oxidized in the blood, and excreted as carbonates in the urine, thereby lessening its acidity: potassium carbonate and bicarbonate, solution of potassium hydroxide, sodium carbonate and bicarbonate, solution of sodium hydroxide, ammonium, lithium, and magnesium carbonates, magnesium oxide, lime water, calcium carbonate, aromatic spirit of ammonia, potassium and sodium acetates, potassium, sodium, and lithium citrates, potassium tartrate and bitartrate, vegetable acids.

6. *Alteratives.*—These alter or change morbid conditions, by furthering metabolism, and modify nutritive processes: iodine, iodides, arsenic, antimony, mercury, sulphur, sulphides, sulphites, phosphorus, sarsaparilla, guaiacum, mezereum, stillingia, colchicum, xanthoxylum, hydrastis, phytolacca, sassafras, codliver oil. Alteratives also are called *Resolvents* and *Discutients* (L. *resolvere,* to resolve, disperse; *discutere,* to disperse) from the fact that they promote absorption of inflammatory deposits, either by stimulating the lymphatic glands, or promoting the imbibition of medicinal or nutritive material in the system.

7. *Astringents* (L. *astringere,* to draw close, contract).—These contract muscular fibre by direct irritation (local), and condense other tissues by precipitating the albumin and gelatin (remote). 1. Mineral: salts of silver, copper, lead, zinc, bismuth, and aluminum. 2. Vegetable: tannic and gallic acids, nutgall, white oak, geranium, gambir, catechu, kino, krameria, hæmatoxylon, hamamelis, red rose, uva ursi.

III. Agents Promoting the Destruction of Microbes, Parasites, etc.

8. *Antizymotics* (Gr. ἀντί, against, + ζυμωτικός, fermentation).—These arrest fermentation dependent upon organic ferments (enzymes): diastase, pepsin, ptyalin; or upon organized ferments: yeast, bacteria, etc.: (*a*) *Antiseptics* (Gr. ἀντί, against, + σηπτικός, rottening)—which prevent or retard septic decomposition, by killing the bacilli producing it, or by arresting their development: corrosive mercuric chloride, hydrogen peroxide, potassium permanganate, sulphurous acid, phenol, cresol, creosote, lysol, thymol, eucalyptol, menthol, sodium borate, boracic acid, chlorine, zinc chloride; (*b*) *Disinfectants* (L. *dis, di,* in two,

apart, from, + *inficere, infectus*, infect(ion)—which destroy specific germs communicating disease (mostly microbes), by (1) acting as oxidizants, (2) combining with albumin, (3) chemically combining to form substitution-compounds, (4) arresting molecular changes, (5) altering the reaction of the media containing the germs: heat (110–121° C.; 230–250° F.), lime, chlorinated lime and soda, ferrous sulphate, zinc chloride, potassium permanganate and dichromate, sulphurous and nitrous acids, sulphur dioxide, formaldehyde, air, water, fire; (*c*) *Deodorants* (L. *de*, from, + *odorare, odoran(t)s*, smelling)—which destroy foul odors. These may be volatile (oxidizing and deoxidizing) agents, that act chemically on obnoxious gases: chlorine, sulphur dioxide, hydrogen dioxide, formalin; or non-volatile (chiefly absorbents) agents that act by condensing and decomposing the effluvia: potassium permanganate, charcoal, earth, lime, ferrous sulphate, etc.

9. *Parasiticides, Germicides* (Gr. *παρά*, besides, upon, + *σιτεῖν*, to feed; L. *parasitus*, parasite, + *cædere*, to kill).—These kill animal and vegetable parasites existing upon the system, being applied usually in the form of lotions, solutions, washes, ointments, and oleates: staphisagria, corrosive mercuric chloride, mercuric nitrate and oxide, ammoniated mercury, sulphur, sulphur iodide, phenol, iodoform, aristol, resorcin, naphthalene, betanaphthol, creosote, guaiacol.

IV. AGENTS ACTING ON THE NERVOUS SYSTEM (NEUROTICS, NERVINES).

10. *Cerebral Excitants, Stimulants, Antispasmodics* (L. *stimulare, stimulus*, to urge, stimulate, a goad, excitant; Gr. *ἀντί*, against, + *σπασμός*, a spasm).—These increase the functional activity of the brain without causing subsequent depression or suspension of the cerebral functions: valerian, asafetida, sumbul, musk, camphor, guarana, caffeine (theine), alcohol.

11. *Cerebral Depressants, Sedatives* (L. *sedare, sedatus*, to allay, calm, a pacifier, tranquillizer).—These lower or suspend the higher brain functions after a preliminary stage of excitement: (*a*) *Narcotics* (Gr. *νάρκη*, numbness, stupor)—which at first excite and stimulate all the body functions, then cause profound sleep, stupor, coma, insensibility, and death by paralyzing the medulla-centres governing respiration and other vital functions: opium, morphine, cannabis, lactucarium, cimicifuga; (*b*) *Hypnotics, Soporifics, Somnificants* (Gr. *ὕπνος*, sleep; L. *sopor*, heavy sleep, *somnus*, sleep, + *facere*, to make)—which produce sleep, leaving undisturbed the normal relationship of the mental faculties to the external world; in a broad sense these include narcotics and anæsthetics: hydrated chloral, sulphonal, trional, paraldehyde, chloralformamide, urethane, potassium, sodium, and ammonium bromides; (*c*) *Anodynes, Analgesics* (Gr. *ἀν*, not, + *ὀδύνη, ἄλγος*, pain, without pain, cures pain)—which relieve pain by either depressing sensory centres or impairing nerve-fibre conductility: opium, morphine, belladonna, hyoscyamus, stramonium, coca, cocaine, hops, anti-

pyrine, acetanilid, phenacetin; (*d*) *Anæsthetics* (Gr. ἀν, not, + ἀισθητός, sensible, insensible effect produced)—which reduce sensory nerve-functions until nerves cannot receive or conduct sensation; some directly depress the skin's end-organs, others impair the sensory nerve conductility, others reduce local circulation; these are mostly volatile substances, whose vapor when inhaled sufficiently causes complete unconsciousness, loss of sensation and motion; anodynes only diminish, while anæsthetics temporarily destroy skin and mucous membrane sensibility: ether, chloroform, nitrous oxide, ethyl bromide, methylene bichloride.

12. *Motor Excitants* (*Excito-motors, Spinants*).—These increase functional activity of the motor apparatus and spinal cord, causing, in large doses, disturbances of motility, increased reflex excitability, and tetanic convulsions, finally paralysis from over-stimulation: nux vomica, strychnine, ignatia, picrotoxin, electricity.

13. *Motor Depressants* (*Depresso-motors*).—These lower functional activity of the motor apparatus and spinal cord, in large doses directly paralyzing them: physostigma, conium, gelsemium, potassium, sodium, ammonium, and lithium bromides, amyl nitrite, nitroglycerin, lobelia, alcohol, ether, chloroform.

14. *Mydriatics* (Gr. μυδριάσις, enlarged pupil).—These dilate the pupil; some act locally, other systemically, causing paralysis of the ciliary muscle: atropine, homatropine, hyoscyamine, daturine, duboisine, cocaine.

15. *Myotics* (Gr. μύειν, to close, shut).—These contract the pupil by stimulating the circular muscular fibres of the iris, and by contracting the ciliary muscle so that the eye is accommodated only for near objects: physostigmine, pilocarpine, morphine, anæsthetics (at first), muscarine.

V. Agents Acting on the Respiratory System (Respiration).

16. *Respiratory Stimulants.*—These exalt the functions of the respiratory centre in the medulla, affording deeper and quicker breathing: strychnine, atropine, digitalis, apomorphine, duboisine, emetine, opium (small doses).

17. *Respiratory Sedatives* (*Depressants*).—These lower the respiratory centre's activity, affording shallow and slow respirations: opium, physostigma, gelsemium, aconite, veratrum viride, conium, muscarine, hydrocyanic acid.

18. *Pulmonary Sedatives* (Gr. πλέυμων, πνέυμων, lung; L. *pulmonarius*, pertaining to or affecting the lungs).—These lessen the irritability of the respiratory nerves or centre, thereby diminishing cough and dyspnœa. Some directly depress the centre, others remove irritating substances from the passages, others lessen local congestion, others lower the excitability of the vagus end-organs and afferent filaments of the lungs and respiratory tract: opium, morphine, codeine, hydrocyanic acid, belladonna.

19. *Sternutatories, Errhines* (L. *sternutare*, to sneeze; Gr. ἐν, in, + ῥιν, the nose).—The former cause sneezing; the latter increase nasal secretion when applied to mucous membrane in powdered form: ipecac, quillaja, ammonia, cubeb, etc.

20. *Ciliary Excitants* (L. *cilium*, an eyelid, hair-like process).—These, when dissolved in the mouth, promote bronchial mucous expectoration through reflex excitation of the bronchial and tracheal cilia: acacia, ammonium and sodium chlorides, potassium chlorate.

21. *Expectorants* (L. *ex*, out of, + *pectus, pectoris*, the breast).—These change the broncho-pulmonary mucous membrane secretion, promoting its expulsion: (*a*) Nauseating (Sedative)—which, in large doses, cause vomiting, thereby acting mechanically in expelling the mucus, and, in small doses, increase osmosis from the inflamed mucous membrane; they may increase secretion and lower blood-pressure: tartar emetic, ipecac, apomorphine, lobelia, pilocarpus; (*b*) Stimulating—which stimulate the bronchial mucous membrane that eliminates them, altering the secretion and facilitating expectoration: senega, squill, ammonium carbonate and chloride, benzoin, balsams of Peru and Tolu, tar, turpentine, garlic, onion, licorice, saccharine substances, ammoniac.

VI. Agents Acting on the Circulatory System (Circulation).

22. *Cardiac Stimulants* (*Tonics;* L. *cardiacus;* Gr. καρδία, heart).—These stimulate the cardiac muscle, slowing and strengthening its contractions; excessive quantities may cause sudden death by syncope: digitalis, strophanthus, scoparius, convallaria, cimicifuga, nitroglycerin, nitrites, alcohol, ether, ammonia, heat, galvanism, chloroform.

23. *Cardiac Depressants* (*Sedatives*).—These lessen the force and frequency of the heart's action, controlling its over-action and palpitation; especially do they slow the pulse in sthenic fevers due to local inflammation: aconite, veratrum viride, tartar emetic, senega, pilocarpine, hydrocyanic acid, emetine, quinine (full doses), pulsatilla, grindelia, cold.

VII. Agents Acting on the Digestive System (Digestion).

24. *Sialagogues* (Gr. σίαλον, saliva, + ἄγειν, ἀγωγός, to lead, leading forth).—These promote the secretion and flow of saliva and buccal mucus: (*a*) Topical—which act through reflex irritation, caused by taking something into the mouth: capsicum, ginger, cubeb, mustard, tobacco, pyrethrum, horse-radish, alkalies; (*b*) General—which act through systemic influence on the glands or their secretory nerves during the drug's elimination: pilocarpus, mercurials, antimonials, iodine compounds, physostigma.

25. *Refrigerants* (L. *refrigerare*, to cool).—These allay thirst, giving the sensation of coolness: vegetable and mineral acids (diluted), fruit juices, ice-water, effervescing drinks, diaphoretics.

26. *Dental Anodynes.*—These are used locally in toothache due to caries, thus exposing a nerve filament; aconite, cocaine, opium, morphine, phenol, creosote, oils of clove and peppermint, hydrated chloral.

VIII. Agents Acting on the Excretory System (Excretion).

27. *Carminatives, Aromatics* (L. *carminare, carminativus*, to expel wind).—These expel gases from the stomach and intestines by increasing peristalsis, stimulating the circulation, and relaxing the cardiac and pyloric orifices; also act as diffusible stimulants to the body and mind: cardamom seed, capsicum, ginger, peppermint, spearmint, cinnamon, nutmeg, lavender, calamus, orange, anise, caraway, coriander, fennel, pimenta, pepper, mustard, clove, asafetida, and volatile oil of each.

28. *Emetics* (Gr. ἔμετος, vomiting).—These cause vomiting: (*a*) Local—which, by reflex action, irritate the end-organs of the gastric, pharyngeal, or œsophageal nerves: zinc and copper sulphates, mercury subsulphate, alum, mustard, tepid water; (*b*) Systemic (General)—which act by directly stimulating the vomiting-centres through circulation: ipecac, apomorphine, tartar emetic, senega, squill, lobelia, sanguinaria, compound syrup of squill.

29. *Antiemetics.*—These lessen nausea and vomiting: (*a*) Local—which produce a sedative action on the end-organs of the gastric nerves: ice, phenol, bismuth subnitrate and subcarbonate, cerium oxalate, creosote, small doses of calomel or ipecac, hot water, opium, cocaine; (*b*) General—which act by reducing the irritability of the vomiting-centre in the medulla: opium, bromides, morphine, codeine, hydrated chloral, alcohol, amyl nitrite, food, brandy.

30. *Cathartics, Purgatives* (Gr. καθαρτικός, cleansing; L. *purgare*, to cleanse).—These increase or hasten intestinal evacuations: (*a*) *Aperients, Laxatives* (L. *aperiere*, to open; *laxare*, to loose)—which excite moderate peristalsis, giving soft movements without irritation: magnesia, manna, sulphur, tamarind, almond and olive oils, figs, prunes, oatmeal; (*b*) *Simple Purgatives*—which cause active peristalsis and stimulate secretion of the intestinal glands, giving one or more copious, semi-fluid movements accompanied by some irritation and griping: aloes, calomel, castor oil, cascara sagrada, rhubarb, senna, small doses of salines, drastics, cholagogues; (*c*) *Saline Purgatives*—which stimulate the intestinal glands, increase peristalsis and osmosis, causing watery stools: magnesium sulphate and citrate, potassium sulphate, tartrate and bitartrate, sodium sulphate, phosphate and chloride, potassium and sodium tartrate; (*d*) *Drastic Purgatives* (Gr. δράω, δραστικός, to act, active). These often are called simply cathartics, and act more intensely than the preceding, causing violent peristalsis, watery stools, griping, tenesmus, borborygmus, mucous membrane irritation, and exosmosis of serum; large doses become irritant poisons: colocynth, jalap, gamboge, scammony, croton oil; (*e*) *Hydragogue Purgatives* (Gr. ὕδωρ, water, + ἄγειν, ἀγωγός, to lead, leading forth)—which remove much water from the vessels: croton oil, elaterium,

gamboge, potassium bitartrate, large doses of salines and drastics; (*f*) *Cholagogue Purgatives* (Gr. χολή, bile, + ἄγειν, αγωγός, to lead, leading forth)—which stimulate bile flow, causing free purgation of green-colored (bilious) and liquid stools: mercurials, aloes, rhubarb, podophyllin, euonymin, iridin, leptandrin.

31. *Diuretics* (Gr. δία, through, + οὐρεῖν, to urinate).—These increase renal secretion, either by raising the local or general blood-pressure, thereby increasing renal circulation (blood-supply), or by stimulating the secreting cells or nerves of the kidneys, or by washing out the kidneys with much water taken at night or early morning; (*a*) Refrigerant—which excite the renal epithelium, producing a hyperæmic condition of the kidneys and an increased amount of water in the urine; they depress the heart and general circulation: potassium acetate, citrate and bitartrate, ammonium and sodium acetates, lithium carbonate and citrate, magnesium citrate and sulphate, water, milk, cold applications; (*b*) Hydragogue—which largely increase the amount of water in the urine, owing to raising arterial pressure, locally or generally: digitalis, strophanthus, spirit of nitrous ether, nitrites, squill, cimicifuga, scoparius; (*c*) Stimulant (blennorrhetics)—which act directly upon the renal tissue, by which they are to a great extent eliminated from the body: buchu, copaiba, cubeb, matico, pareira, uva ursi, savin, juniper, chimaphila, taraxacum, cantharides, turpentine, oil of santal, corn silk, apocynum.

32. *Antilithics, Lithotriptics* (Gr. ἀντί, against, + λίθος, stone, + τρίβειν, to rub).—The former prevent the formation of urinary and biliary concretions in the excretory passages; the latter dissolve them when formed: *biliary calculi:* alkaline waters, turpentine, etc.; *vesical calculi:* (1) uric acid or urates: alkaline salts, magnesium citro-borate, etc.; (2) calcium oxalate: acids, carbonated waters, etc.; (3) phosphatic deposits (calculi): ammonium benzoate, nitric acid, etc.

33. *Diaphoretics, Sudorifics* (Gr. δία, through, + φορεῖν, to carry; L. *sudor*, sweat, + *facere*, to make).—These increase the action of the skin, causing sweat-secretion; are called sudorifics when the secretion is so profuse as to form beads on the surface: (*a*) Simple—which enter circulation and stimulate the sudoriferous glands, by which they are eliminated: pilocarpus, ammonium acetate and citrate, sarsaparilla, guaiacum, mezereum, sassafras, senega, serpentaria, salicylates; (*b*) Nauseating—which relax and dilate the superficial capillaries: ipecac, tartar emetic, opium, Dover's powder, alcohol, ether, spirit of nitrous ether, lobelia, tobacco, vapor and Turkish baths, wet-pack, hot drinks; (*c*) Refrigerant—which reduce circulation by acting on the sweat-centres in the spine and medulla: potassium citrate, aconite, veratrum viride, tobacco, lobelia, pilocarpus, spirit of nitrous ether, opium.

34. *Antihydrotics, Anhydrotics* (Gr. ἀντί, against, ἀν, not, + ἰδρώς, sweat).—These check perspiration by reducing the action of the sweat-glands, or the excitability of the sweat-centres, or the circulation in the skin: belladonna, chloralformamide, muscarine, pilocarpine, strychnine, quinine, etc.

35. *Anthelmintics* (Gr. ἀντί, against, + ἑλμινθ, a worm).—These destroy (*Vermicides*, L. *vermis*, worm, + *cædere*, to kill) or expel (*Vermifuges*, L. *vermis*, worm, + *fugare*, to put to flight) intestinal worms. Vermifuges: castor oil, jalap, scammony. Vermicides, for: (*a*) Thread worms (*Oxyuris vermicularis*): vegetable astringents, alum, iron sulphate, aloes, tannin, lime water, quassia, all by enema; (*b*) Round worms (*Ascaris lumbricoides*): santonin, spigelia, chenopodium, each in combination with either calomel (castor oil), senna, or compound jalap powder; (*c*) Tape worms (*Tænia solium* +) *Tænifuges:* aspidium, kamala, kousso, pomegranate, pumpkin seed, turpentine.

IX. AGENTS ACTING ON THE REPRODUCTIVE SYSTEM (GENERATION).

36. *Emmenagogues* (Gr. ἔμμηνος, monthly, + ἄγειν, ἀγωγός, to lead, leading forth).—These restore the menstrual function, either by stimulating directly the uterine muscular fibre, or indirectly enriching the blood, thus toning up the nervous system: (*a*) Direct—which act locally on the uterus: ergot, rue, tansy, savin, cantharides, myrrh, guaiacum, apiol, hedeoma, cimicifuga, caulophyllum, pulsatilla, potassium permanganate; (*b*) Indirect—which act generally on the system: iron, manganese, quinine, strychnine, aloetic purgatives, tonics, hot hip baths, codliver oil.

37. *Ecbolics, Oxytocics* (Gr. ἐϰ, out of, + βάλλειν, to throw out; ὀξύς, quick, + τόϰος, birth).—These stimulate the muscular fibres of the gravid uterus to contraction, thus causing premature birth or abortion: ergot, cottonroot bark, savin, hydrastis, potassium permanganate, oils of rue, tansy, and pennyroyal.

38. *Aphrodisiacs* (Gr. Ἀφροδίτη, Venus, Greek goddess of love, venereal).—These stimulate sexual appetite and power by acting reflexly or directly upon the cerebral or spinal genital centre: damiana, phosphorus, cantharides, tonics, ergot, meat diet, strychnine, cannabis, alcohol.

39. *Anaphrodisiacs* (Gr. ἀν, not, + Ἀφροδίτη).—These lessen sexual functions and appetite, by diminishing excitability of the nerves of the genital organs, also by depressing the genital centres in the brain and spine, and by decreasing local circulation: bromides, camphor, opium, tobacco, purgation, venesection, cold baths, ice, vegetable diet, cocaine, belladonna.

40. *Galactagogues* (Gr. γάλα, milk, + ἄγειν, ἄγωγός, to lead, leading forth).—These increase lacteal secretion: pilocarpus, ricinus (leaves locally), thea (internally with alcohol, beer, porter), etc.

X. AGENTS ACTING ON THE CUTANEOUS SYSTEM (SKIN).

41. *Irritants, Counter-irritants.*—These when applied to the skin cause vascular excitement; are called counter-irritants when used to produce reflex influence on remote parts: (*a*) *Rubefacients* (L. *rubere,* to be red, + *facere,* to make)—which produce temporary redness and

skin congestion; if left on too long, may cause exudation between the cuticle and true skin (vesicants), or may destroy the tissue, forming a slough (escharotics), or may cause muscular atrophy: mustard, capsicum, mezereum, iodine, menthol, ammonia, arnica, volatile oils (turpentine, cajuput, etc.), hot water, friction; (*b*) *Vesicants, Epispastics, Blisters* (L. *vesica*, a blister; Gr. ἐπί, upon, + σπᾶν, to draw)—which produce much inflammation of the skin and effusion of serum between the epidermis and derma: cantharides, mezereum, iodine, rhus toxicodendron, glacial acetic acid, volatile oil of mustard, steam, boiling water, ammonia vapor; (*c*) *Pustulants* (L. *pustulare*, to blister)—which cause pustules, and affect isolated parts of the skin, as orifices of sudoriferous glands: croton oil, tartar emetic, silver nitrate; (*d*) *Escharotics, Caustics* (Gr. ἐσχάρα, a scab, scar)—which destroy tissue when applied, by abstracting its water, or by combining with the albumin of the skin, or by corrosive deoxidation of the tissues, thus causing a slough: mineral acids, phenol, chromic acid, lime, potassium and sodium hydroxides, dried alum, silver nitrate, zinc chloride, copper sulphate, corrosive mercuric chloride, mercuric oxide and nitrate, bromine, high heat, electric cautery, boiling water, arsenic trioxide.

42. *Styptics, Hæmostatics* (L. *stypticus*, contracting; Gr. αἷμα, blood, + ἱστάναι, στατικός, to stop, stopping).—These arrest hemorrhage; the former being used locally, the latter internally. Some act mechanically, by closing the mouths of the bleeding vessels with a blood-clot; others contract the vessels, thus checking the blood-flow: (1) acids, alum, collodion, ferric chloride and sulphate, silver nitrate, matico, tannin, lead acetate, zinc sulphate, vegetable astringents, cold (locally), electric cautery; (2) ergot, gallic acid, matico, lead acetate, diluted sulphuric acid, hamamelis, oil of turpentine, heat (locally).

43. *Emollients* (L. *emollire*, to soften).—These soften and relax the tissues when applied locally, diminish the tension and pressure on the nerves, dilate the vessels, and protect inflamed surfaces: poultices, fatty oils, lard, spermaceti, glycerin, petroleum, starch, soap liniment, cacao-butter.

44. *Demulcents* (L. *demulcere*, to soothe).—These, usually mucilaginous or oleaginous, are intended for soothing parts to which applied, being restricted generally to mucous membranes (internally), and emollients to the skin (externally): acacia, cetraria, starch, flaxseed, licorice, gelatin, honey, althæa, egg-white, tragacanth, olive and other bland oils.

45. *Protectives*.—These are mechanical coverings to protect various injured parts from air, water, friction, etc.; collodion, plasters, etc.

V. Arrangement by Natural Affinities (Botanical).—This system is the one adopted throughout this work. It is of all others the most scientific by which plants may be studied, and, as the official portions of vegetable drugs are but parts of the whole, it seems only natural that the parental source should furnish the basis of classification for these medicinal parts. Everyone knows that there are greater similarities and dissimilarities between some plants than between others, and that this likewise applies to animals. Scientists, taking advantage of this fact, have for several centuries been trying to form groups of plants, each to contain only those possessing, in common, certain marks of resemblance, and so naming the same, when possible, to typify the strongest characteristic. Early botanists were content with one point of agreement, but they differed even as to what plant-organ, above all others, should be accepted to furnish this point, hence the basis of a system. Cæsalpinus (1519–1603) selected the fruit, the globular furnishing one class, the flat another, etc. Tournefort (1656–1708) took the flower, restricting himself to the modification and arrangement of the corolla, the cup-shaped being one class, the bell-shaped another, etc. Linnæus (1707–1778) went a step further, and founded classes and orders upon the position, number, and relative lengths of the stamens and pistils, giving us the Linnæan, artificial, or sexual system of plants. This worked very well until cultivation, climatic differences, etc., changed the number of stamens and pistils. So far, no one had taken into consideration the plant's entirety. It is to John Ray (1628–1705), often called the "father of English natural history," that we owe the conception of a broader and more natural system; but it was Jussieu (1748–1836) who, embodying the grand features of both Ray and Tournefort, laid the permanent foundation of the true natural system which, somewhat modified, has come down to us. The very foundation of this system necessitates the faithful consideration of the similarities in form, structure, growth, habits, functions, thereby involving the idea of "affinity in essential organs." These understood, we may arrange the entire vegetable kingdom into allied groups of a scaling grade, dependent upon their whole make-up, thus placing each family (natural order) genus, and species next to those it most resembles in all respects.

Families or Natural Orders.—Of these there are about 280; they are the broader groups, and each comprises plants resembling one another in some strong particular, which applies to them generally as a class; this characteristic usually is taken from one of the reproductive organs (flowers, fruit, seed), and is so striking as to be noticeable by the inexperienced: Leguminosæ (fruit in legumes), Umbelliferæ (flowers in umbels), Compositæ (flowers compound), Labiatæ (corolla 2-lipped), Cupuliferæ (fruit in cupule), Guttiferæ (juice exudes in drops), Coniferæ (fruit in cones), Cruciferæ (petals arranged like a Maltese cross), etc.

Genus, Genera.—Of these there are about 10,000; they are more restricted groups, and go to compose the families or natural orders. This name corresponds to the family, surname, or last name of persons, Brown, Jones, Smith; it is a noun, and, like the family (ordinal) name, begins with a capital. Genera also are grouped according to some certain but more restricted characteristic taken from the reproductive organs; hence a genus is a collection of species resembling one another in the structure and general characters of the organs of reproduction, or in reproductive processes, methods of fructification, pollination, etc. Plants of the same genus are expected to be on the same numerical plan, and to have flowers, constituents, and medicinal properties somewhat similar.

Species, Species.—Of these there are about 200,000; they are the most restricted permanent groups and make up the various genera. This name corresponds to the baptismal or first name of persons, James, John, William; it is usually an adjective agreeing in case and gender with generic name, and, as such, should begin with a small letter. These are grouped according to some certain but still more restricted characteristics taken usually from the vegetative organs (root, stem, leaves), as color, proportion, shape, surface, duration, division, etc.; hence, species is a succession of individuals which reproduces and perpetuates itself. The last two names, generic and specific, when taken together, constitute the plant's name—*i. e.*, botanical source or origin—and consequently every plant (and animal) thus always is designated.

There are two scientific methods (with their many modifications) of arranging each family (natural order), genus, and species toward its nearest neighbor. Thus we may follow Jussieu's sequence, beginning with the cellular, flowerless, or lowest plant-life (Algæ), advancing to those of vascular structure, with apologetic, imperfect, or incomplete floral parts, always having each to follow in the ascending scale, finally reaching those producing as then understood the most perfect, complete, and typical flowers (Ranunculaceæ). De Candolle (1778–1841) greatly innovated this system, but chiefly in reversing the arrangement, placing the most highly organized plants, or flower producers, first in order, and each lower one in a descending succession. This would seem the most unnatural, as the order of development in nature surely suggests evolution from forms more simple to those more complex, and not the converse. In spite of this, however, it has universally been accepted for the past half-century, being strongly indorsed and followed by many of the world's greatest botanists, including Bentley, Trimen, Hanbury, Gray, Balfour, Bentham, Hooker, etc.; and is enunciated best by Bentham and Hooker in their *Genera Plantarum.*

The other plan, being the most rational, has continued always to have supporters, and during the past two decades has been studied systematically and thoroughly, especially in Germany, with more than ordinary zeal and results. Such scholars as Eichler, Engler, Prantl, Thomé, Potonié, Richter, Flückiger, Köhler, Stasburger, Schenck, Schimper, etc., have instituted many changes, and, although beginning with the most primitive plant-life and ending with those bearing most complex flowers (Compositæ), have succeeded in evolving the system in a form much more consistent and in harmony with modern scientific thought and general plant-nature. As such, it is enunciated best by Engler and Prantl in their *Die Natürlichen Pflanzenfamilien*, and by Engler in his *Syllabus der Pflanzenfamilien*, and as this is the sequence that necessarily must come into future favor, it has been thought wise, in the main, to adhere to it in this work, giving thereto the following synopsis:

SUB-KINGDOM I. **THALLOPHYT(ES)-A.**

CLASS 1. **ALGÆ.**

1. *Gigartinaceæ.*—Distinguished by being parenchymatous plants, growing in fresh or salt water, or moist places, red, purple, or violet hue, less commonly green or blackish; composed of 250 species. *Chondrus, Gigartina.*

CLASS 2. **FUNGI.**

2. *Hypocreaceæ.*—Distinguished by rarely containing chlorophyll, saprophytes, parasites, either soft, fibrous, gelatinous, fleshy, leathery, horny, mycelium inconspicuous, often producing a dense homogeneous tissue; composed of 200 species. *Claviceps.*

SUB-KINGDOM II. **PTERIDOPHYT(ES)-A.**

CLASS 3. **FILICINÆ.**

3. *Polypodiaceæ.*—Distinguished by leaves being fronds, large, spores one kind, in cases (sporangia) on under surface or margin, circinate in vernation, stems usually prostrate, subterranean; composed of 70 genera, 3000 species. *Dryopteris.*

CLASS 4. **LYCOPODINÆ.**

4. *Lycopodiaceæ.*—Distinguished by yellow spores, low, usually moss-like evergreens, stems much branched, elongated, sporangia 1–3-celled, solitary in the axils of leaves, or on their upper surface; composed of 125 species. *Lycopodium.*

SUB-KINGDOM III. **SPERMATOPHYT(ES)-A.**

CLASS 5. **GYMNOSPERMÆ.**

5. *Pinaceæ* (*Coniferæ*).—Distinguished as resinous, evergreen trees, shrubs, flowers unisexual, no perianth, staminate—catkins, pistillate—scaly aments, becoming cones, sepals naked (2), leaves needle-shaped; composed of 25 genera, 240 species. *Pinus, Juniperus.*

CLASS 6. **ANGIOSPERMÆ.**

SUB-CLASS 1. **Monocotyledones.**

6. *Graminaceæ.*—Distinguished by glumaceous flowers, paleæ 2 in each, stamens hypogynous, stems hollow, jointed, leaves 2-ranked; composed of 3500 species. *Zea, Saccharum, Beta, Agropyron, Hordeum.*

7. *Palmaceæ.*—Distinguished by plants being unbranched, leaves large, plaited, palmately parallel-veined, in one terminal cluster, perianth double, 3-merous; composed of 129 genera, 1100 species. *Serenoa.*

8. *Melanthaceæ.*—Distinguished by ovary superior, capsules mostly septicidal, with rootstocks, rarely bulbs, perianth 6, stamens 6, seeds appendaged, leaves grass-like, polygamous or diœcious; composed of 36 genera, 140 species. *Veratrum, Asagræa.*

9. *Liliaceæ.*—Distinguished by regular, symmetrical flowers, 6's, perianth non-glumaceous, petaloid, hypogynous, ovary 3-celled, anther 2-celled; composed of 125 genera, 1300 species. *Urginea, Aloe.*

10. *Convallariaceæ.*—Distinguished by being erect herbs, fruit—fleshy berry, no tendrils, never with bulbs or corms, flowers solitary, regular, perfect, 6's, ovary superior; composed of 23 genera, 215 species. *Colchicum.*

11. *Smilaceæ.*—Distinguished by being mostly vines, woody, herbaceous, often prickly stems, leaves net-veined, flowers green, diœcious, perianth 6, stamens 6, fruit globose berry, 1–6-seeded; composed of 3 genera, 200 species. *Smilax.*

12. *Zingiberaceæ.*—Distinguished by creeping rhizomes, calyx and corolla distinct, each 3, leaves stalked, sheathing, ovary inferior, stamens 6; composed of 30 genera, 280 species. *Elettaria, Zingiber.*

13. *Orchidaceæ.*—Distinguished by the 1–2 sessile anthers united to pistil, flowers irregular, reptile-shape, perfect, perianth 6 in 2 rows, petaloid; composed of 410 genera, 5000 species. *Vanilla.*

SUB-CLASS 2. **Dicotyledones.**

SERIES I. Choripetalæ.

14. *Piperaceæ.*—Distinguished by jointed stems, ovary sincarpic, 1-celled, stigma sessile, 2, 3, 4, fruit fleshy, 1-celled, 1-seeded; composed of 8 genera, 1060 species. *Piper* (*Cubeba*).

15. *Salicaceæ.*—Distinguished by diœcious flowers, both kinds in catkins, no perianth or only cup-like calyx, stamens 1–30, fruit capsule; composed of 2 genera, 200 species. *Salix, Populus.*

16. *Fagaceæ* (*Cupuliferæ*).—Distinguished by small flowers, monœcious, staminate—aments, pistillate subtended by involucre (united bracts) becoming a bur (cup), petals none, stamens 4–20, perianth 4–8-lobed; composed of 5 genera, 375 species. *Quercus.*

17. *Ulmaceæ.*—Distinguished by fugacious stipules, small flowers, monœcious, diœcious, perfect or polygamous, perianth 3–9-parted, or sepals, petals none, stamens 3–9, ovary 1-celled, superior, samara, drupe or nut; composed of 13 genera, 140 species. *Ulmus.*

18. *Moraceæ.*—Distinguished by having milky juice, small flowers, monœcious, diœcious, calyx 4–5-parted, petals none, stamens 4–5, ovary 1-celled, superior, fruit various; composed of 55 genera, 925 species. *Humulus, Cannabis.*

19. *Santalaceæ.*—Distinguished by calyx 4–5 valvate-lobed, green or petaloid, stamens perigynous, sheathing disk, ovules suspended by funiculus; composed of 26 genera, 250 species. *Santalum.*

20. *Aristolochiaceæ.*—Distinguished by colored, irregular calyx, epigynous stamens, fruit capsule, many-seeded, leaves cordate; composed of 5 genera, 200 species. *Aristolochia.*

21. *Polygonaceæ.*—Distinguished by stems having many swollen joints, ochriate stipules above each, flowers perfect, calyx colored or greenish, ovary superior, 1-celled; composed of 30 genera, 800 species. *Rheum.*

22. *Chenopodiaceæ.*—Distinguished by succulency and flowers being ebracteated, minute, greenish, perfect or unisexual, ovary superior, 1-celled, fruit 1-seeded utricle; composed of 75 genera, 550 species. *Chenopodium.*

23. *Myristicaceæ.*—Distinguished by leaves alternate, dotted, leathery, flowers diœcious, regular, calyx 3–4-cleft, filaments 3–12, united, ovary 1-celled, ovule 1, fruit succulent; composed of 5 genera, 100 species. *Myristica.*

24. *Ranunculaceæ.*—Distinguished by flowers being most complete, organs all distinct, no adhesions nor cohesion, often yellow; composed of 35 genera, 1050 species. *Hydrastis, Cimicifuga, Delphinium, Aconitum.*

25. *Berberidaceæ.*—Distinguished by the few stamens being in 2–3 whorls and anthers opening by two hinged valves (Podophyllum—longitudinal); composed of 20 genera, 105 species. *Podophyllum.*

26. *Menispermaceæ.*—Distinguished by flowers being diœcious, petals shorter than sepals, solitary seed moon- or kidney-shaped, woody climbers; composed of 55 genera, 150 species. *Jateorhiza.*

27. *Lauraceæ.*—Distinguished by polygamous flowers, calyx inferior, petaloid, anthers opened by 2–4 uplifted valves, ovary 1-celled, fruit drupe or berry; composed of 40 genera, 900 species. *Sassafras, Cinnamomum.*

28. *Papaveraceæ.*—Distinguished by the 2–3 fugacious sepals and minute embryo near the base of fleshy albumin; composed of 26 genera, 200 species. *Papaver, Sanguinaria.*

29. *Cruciferæ.*—Distinguished by pungent or acrid juice, cruciform flowers, tetradynamous stamens, and fruit a silique or silicle; composed of 185 genera, 1500 species. *Sinapis, Brassica.*

30. *Hamamelidaceæ.*—Distinguished by ovary being inferior, ovule solitary, pendent from cell apex, fruit capsule, 2-celled; composed of 15 genera, 35 species. *Hamamelis, Liquidambar.*

31. *Rosaceæ.*—Distinguished by prickles, warts on woody surface, flowers regular, stamens inserted on calyx tube, perigynous; composed of 65 genera, 1200 species. *Rosa.*

32. *Drupaceæ.*—Distinguished by bark exuding gum, bark and seeds containing hydrocyanic acid, calyx 5-lobed, free from ovary, petals (5), stamens (many) inserted on calyx, ovary 1-celled, 2-ovuled, drupe; composed of 6 genera, 110 species. *Prunus* (*Amygdalus*).

Leguminosæ.

33. *Mimosaceæ.*—Distinguished by ovary several-ovuled, fruit legumes, leaves 2–3-pinnate, flowers small, regular, calyx 3–6-lobed, corolla 3–6, stamens distinct or monadelphous, ovary 1-celled; composed of 30 genera, 1350 species. *Acacia.*

34. *Cæsalpinaceæ.*—Distinguished by legumes, upper petal enclosed by lateral ones in the bud, leaves compound, stipulate, flowers perfect, monœcious, diœcious, polygamous, 5's; composed of 90 genera, 1000 species. *Cassia* (*Cathartocarpus*), *Copaiba.*

35. *Papilionaceæ.*—Distinguished by legumes or loments, upper petal enclosing lateral ones in the bud, leaves compound, stipulate, calyx 4–5-toothed, petals somewhat united (banner, wings, keel), stamens usually 10, pistil 1, superior; composed of 310 genera, 5000 species. *Toluifera, Astragalus, Pterocarpus, Glycyrrhiza, Cytisus, Vouacapoua, Physostigma.*

36. *Linaceæ.*—Distinguished by flowers being regular, showy, stamens monadelphous at base, sepals imbricate, ovary 3–5-celled, composed of 4 genera, 150 species. *Linum.*

37. *Erythroxylaceæ.*—Distinguished from Linaceæ by the shrubby or arboreous habit, and by the drupaceous fruit, calyx 5-lobed, petals 5, stamens 10, hypogynous, ovary superior; composed of 3 genera, 60 species. *Erythroxylon.*

38. *Zygophyllaceæ.*—Distinguished by flowers bearing a fleshy disk, white, red, yellow, sepals 5, free, glandless; composed of 20 genera, 150 species. *Guaiacum* (*Guajacum*).

39. *Rutaceæ.*—Distinguished by leaves being exstipulate, dotted, petals imbricated, ovary sessile, surrounded at base by fleshy, glandular disk, or elevated on gynophore; composed of 110 genera, 880 species. *Xanthoxylum, Pilocarpus, Barosma, Citrus.*

40. *Simarubaceæ.*—Distinguished from Rutaceæ by leaves being exstipulate, without glands or dots, disk conspicuous, ovary stalked; composed of 30 genera, 112 species. *Picrasma, Quassia.*

41. *Burseraceæ.*—Distinguished by secreting a resinous or gum-resinous juice, leaves compound, dotted, disk and stamens perigynous, ovary superior; composed of 26 genera, 150 species. *Commiphora.*

42. *Polygalaceæ.*—Distinguished by flowers being irregular, papilionaceous, stamens monadelphous, sepals 5, of which 2 inner are wing-like, petaloid; composed of 10 genera, 150 species. *Polygala.*

43. *Euphorbiaceæ.*—Distinguished by milky, acrid juice, flowers unisexual, apetalous, fruit tricoccous, 3–6-seeded capsule, radical superior; composed of 210 genera, 4000 species. *Croton, Ricinus, Stillingia.*

44. *Sapindaceæ.*—Distinguished by flowers being unsymmetrical, hypogynous, leaves compound, sepals and petals on a fleshy, glandular disk; composed of 120 genera, 1000 species. *Paullinia.*

45. *Rhamnaceæ.*—Distinguished by its spiny habit, perigynous stamens, concave petals, non-caducous, valvate sepals, fruit not a berry; composed of 45 genera, 575 species. *Rhamnus.*

46. *Malvaceæ.*—Distinguished by stamens monadelphous, anthers 1-celled, leaves often downy, palmate-divided; flowers showy, purple, yellow, white; composed of 40 genera, 800 species. *Althæa, Gossypium.*

47. *Sterculiaceæ.*—Distinguished by flowers being regular or irregular, petals sometimes absent, filaments usually monadelphous, anthers 2-celled; composed of 49 genera, 730 species. *Theobroma.*

48. *Theaceæ* (*Ternstræmiaceæ*).—Distinguished by sepals distinct, endosperm little or none, leaves alternate, flowers large, solitary, sepals 5, petals 5, hypogynous, ovary 2–several-celled, fruit 2–3-celled, woody capsule; composed of 16 genera, 160 species. *Thea.*

49. *Guttiferæ.*—Distinguished by yielding a resinous juice, stamens distinct, monadelphous or polyadelphous, flowers unisexual or polygamous, leaves coriaceous; composed of 24 genera, 340 species. *Garcinia.*

50. *Thymelæaceæ.*—Distinguished by calyx being petaloid, 4–5 imbricated lobes, stamens perigynous, radical superior, ovary 1-celled, fruit drupe; composed of 37 genera, 425 species. *Daphne.*

51. *Lythraceæ (Punicaceæ).*—Distinguished by calyx lobes being valvate, petals wrinkled, leaves exstipulate, stamens perigynous, inserted below the petals; composed of 21 genera, 350 species. *Punica.*

52. *Myrtaceæ.*—Distinguished by numerous stamens, leaves exstipulate, opposite, dotted, with marginal vein, ovary inferior; composed of 76 genera, 2700 species. *Melaleuca (Cajuputi), Eugenia, Pimenta, Eucalyptus.*

53. *Umbelliferæ.*—Distinguished by the 2-celled ovary forming a cremocarp, with vittæ (oil-tubes), flowers in umbels, stems hollow, ovary inferior, crowned with fleshy disk; composed of 170 genera, 1600 species. *Petroselinum, Pimpinella, Fœniculum, Carum, Coriandrum, Ferula.*

SERIES II. Gamopetalæ.

54. *Ericaceæ.*—Distinguished by hypogynous corolla and stamens, anthers 2-celled, dehiscing by pores or slits, ovary 2–5-celled, leaves exstipulate, fruit capsule or berry; composed of 55 genera, 1050 species. *Gaultheria, Arctostaphylos.*

55. *Styraceæ.*—Distinguished by flowers of 5–10 stamens attached to 5-lobed corolla, anthers 2-celled, calyx coherent with ovary, superior or part inferior, fruit drupe; composed of 7 genera, 75 species. *Styrax.*

56. *Oleaceæ.*—Distinguished by 2 stamens, ovary superior, 2-celled, each with 2 ovules, corolla regular, 4–8-cleft, fruit capsule, berry, or drupe, seed albuminous, oily; composed of 21 genera, 500 species. *Olea, Fraxinus.*

57. *Loganiaceæ.*—Distinguished by opposite, entire, stipulate leaves, stamens epipetalous, styles divided as ovary cells number, fruit capsule, drupe, seeds winged; composed of 30 genera, 400 species. *Gelsemium, Spigelia, Strychnos.*

58. *Gentianaceæ.*—Distinguished by being smooth herbs, leaves entire, glabrous, sessile, calyx and corolla persistent, ovary superior, fruit 2-celled capsule; composed of 65 genera, 600 species. *Gentiana.*

59. *Apocynaceæ.*—Distinguished by milky juice, from Asclepiadaceæ by stamens being free from style and stigma, anthers contain granular pollen, stigma hour-glass-shaped; composed of 130 genera, 1050 species. *Strophanthus, Aspidosperma.*

60. *Convolvulaceæ.*—Distinguished by milky juice, from Solanaceæ and Scrophulariaceæ by twining, trailing habit, alternate leaves, large solitary seeds, crumpled embryo, corolla 5's, plaited; composed of 40 genera, 900 species. *Exogonium, Convolvulus.*

61. *Hydrophyllaceæ.*—Distinguished by watery, insipid juice, flowers scorpioid, 5's, stamens borne on corolla base, styles 2, fruit capsule; composed of 17 genera, 160 species. *Eriodictyon.*

62. *Labiatæ.*—Distinguished by square stems, corolla bilabiate, stamens 4, didynamous, ovary 4-lobed, leaves aromatic, stigma bifid, fruit achenes; composed of 160 genera, 3000 species. *Thymus, Mentha, Lavandula, Rosmarinus.*

63. *Solanaceæ.*—Distinguished by colorless juice, flowers with plicate border, isomerous, ovules many, fruit capsule or berry, ovary superior; composed of 70 genera, 1600 species. *Capsicum, Atropa, Hyoscyamus, Datura.*

64. *Scrophulariaceæ.*—Distinguished by 2-celled ovary, numerous seeds, fleshy albumin, calyx 5-lobed, corolla irregular, 2-lipped, stamens 4, didynamous, ovary sessile, 2-celled, fruit capsule or berry; composed of 165 genera, 2500 species. *Digitalis.*

65. *Pedaliaceæ.*—Distinguished by being glandular, oily seed, entire, exstipulate leaves, large, irregular flowers, calyx 5-cleft, corolla bilabiate, stamens didynamous, fruit drupe; composed of 14 genera, 50 species. *Sesamum.*

66. *Rubiaceæ.*—Distinguished by regular, epigynous corolla, valvate lobes, salver, rotate, or funnel-shaped, stamens on corolla-tube, epipetalous, ovary crowned with an epigynous disk, fruit capsule or fleshy nuts; composed of 355 genera, 5500 species. *Coffea, Cephaëlis, Cinchona, Ourouparia.*

67. *Caprifoliaceæ.*—Distinguished by gamopetalous corolla, leaves opposite, exstipulate, stamens on corolla-tube, ovary inferior, fruit berry or drupe; composed of 10 genera, 260 species. *Viburnum.*

68. *Valerianaceæ.*—Distinguished by corolla being epigynous, anthers free, seed exalbuminous, leaves exstipulate, ovary inferior, 3-celled, 2 empty; composed of 9 genera, 275 species. *Valeriana.*

69. *Cucurbitaceæ.*—Distinguished by stems being succulent, prostrate or climbing, with tendrils, flowers unisexual, leaves and stem scabrous, fruit pulpy; composed of 90 genera, 650 species. *Cucurbita, Citrullus, Ecballium.*

70. *Campanulaceæ.*—Distinguished by endosperm present, fleshy, usually milky juice, flowers perfect, calyx 5-lobed, gamopetalous, stamens 5, ovary 2–5-celled, fruit capsule or berry, seeds many; composed of 60 genera, 1500 species. *Lobelia.*

71. *Cichoriaceæ.*—Distinguished by flowers all expanded into rays (ligulate), juice milky, calyx-tube adnate to ovary, gamopetalous, 5-toothed, anthers connate, ovary 5-celled, ovule 1, fruit achene; composed of 65 genera, 1400 species. *Taraxacum, Lactuca.*

72. *Compositæ.*—Distinguished by compound flowers, watery or resinous (rarely milky) sap, calyx-tube adnate to ovary, corolla 5-lobed, stamens 5, borne on corolla, anthers syngenesious, ovary 5-celled, ovule 1, fruit achene; composed of 760 genera, 10,000 species. *Grindelia, Matricaria, Anacyclus, Artemisia, Arnica.*

PART I.

ORGANIC DRUGS FROM THE VEGETABLE KINGDOM.

SUB-KINGDOM I. **THALLOPHYT(ES)-A.**

CELLULAR cryptogams, composed of one or many cells, with no differentiation of root, stem, or leaves, the thallus being without true woody fibres and vessels.

CLASS 1. **ALGÆ.**

1. GIGARTINACEÆ. Red Seaweed Family.

Gig-ar-ti-na′se-e. L. *Gigartin-a* + aceæ, fr. Gr. *γίγαρτον,* a grapestone—*i. e.,* from the resemblance of the capsules (cystocarps), which are oval, appearing as little elevated or stalked tubercles on the flat portions of the frond (thallus). Composed of many fleshy, gelatinous algæ, red, purple, or violet, with thalli flat and somewhat forked, but without distinction of nodes and branches; form and structure varying, while reproductive processes are complex; auxiliary cells and carpogonia separate, but usually in groups; universal; nutritious, demulcent, alterative.

Genera: **1. Chondrus. 2. Gigartina.**

CHONDRUS. CHONDRUS.

Chondrus crispus, (*Linné*) *Stackhouse,*
Gigartina mamillosa, (*Goodenough et Woodward*) *Agardh.* } The dried plants.

Habitat. North Atlantic Ocean, New England, Irish Coast.

Syn. Irish Moss, Carrag(h)een, Carragreen (Moss), Killeen, Pearl Moss, Pig-wrack, Salt Rock Moss, Fucus Crispus; Fr. Carragaheen, Mousse (Marine) perlée; Ger. Carrageen, Irländisches Moos, Perl Moos, Knorpeltang.

Chon′drus. L. fr. Gr. *χόνδρος,* cartilage, gristle—*i. e.,* fronds are cartilaginous.

Cris′pus. L. curled, crumpled—*i. e.,* its physical appearance.

Gig-ar-ti′na. L. see etymology, above, of Gigartinaceæ.

Ma-mil-lo′sa. L. *mamillosus,* breasted, filled with papillæ or breasts—*i. e.,* from resemblance of the spores on the surface and margins of the fronds.

PLANTS.—Entire, more or less matted together, consisting of slender stalk branching dichotomously, segments flattened, emarginate or deeply cleft at tips, 5–15 Cm. (2–6′) long, 1–10 Mm. ($\frac{1}{25}$–$\frac{2}{5}$′) broad, yellowish-white, translucent, frequently coated with a calcareous deposit effervescing with hydrochloric acid, sometimes sporangia embedded near apex of segments (*C. crispus*) or on short stalks scattered over upper portion of segments (*G. mamillosa*), somewhat cartilaginous; odor slight, seaweed-like; taste mucilaginous, saline. *Tests:* 1. Boil for 10 minutes 1 part with water (30), replacing evaporation—strained liquid forms thick jelly upon cooling. 2. Soft, gelatinous, and transparent with cold water; boil .3 Gm. in 100 Ml. (Cc.) of water, filtrate + tannic acid T. S.—no precipitate (abs. of gelatin); when cold + iodine T. S.—no blue (abs. of starch). *Solvent:* water. Dose, ʒj–2 (4–8 Gm.).

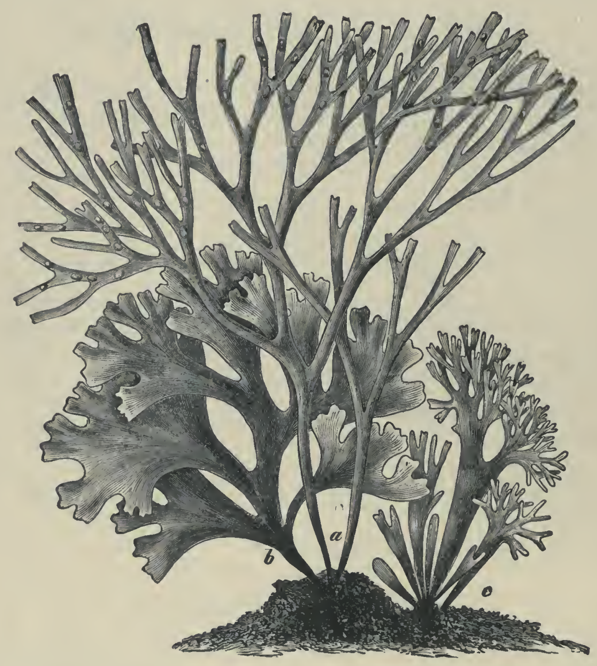


Fig. 1.—*Chondrus crispus: a*, narrow form, with fruit; *b*, broad form; *c*, small form.

Adulterations.—Allied plants, especially *Gigartina acicularis* and *G. pistillata*, which resemble the official very closely.

Commercial.—Plants, commonly known as seaweed or bladderwrack, grow attached by a small disk to submerged rocks, and, unless bleached, are greenish (fresh) or purplish (dry). Although the spring crop is superior (that of summer often being attacked by black mildew), yet most is collected, June–August, on the coasts of Ireland and Massachusetts, by boatmen tearing it from rocks, 3–6 M. (10–20°) under water, with rakes, hooks and tongs, or some is taken directly from the beach where left by storms and tides; it is then washed in seawater and spread high upon the shore for one or more weeks to become partly bleached by sun and dew, and afterward put into hogsheads, rolled in marshes until saturated with seawater (avoiding fresh water) and spread out on land, a dual treatment repeated several times to obtain the desired yellowish-white color; finally it is dried in barns and packed in barrels (100 pounds; 45 Kg.).

Constituents.—Mucilage 55–90 p. c., Minerals 14 p. c., albuminoids 9 p. c., water 18 p. c., cellulose 2 p. c., ash 8–15 p. c.

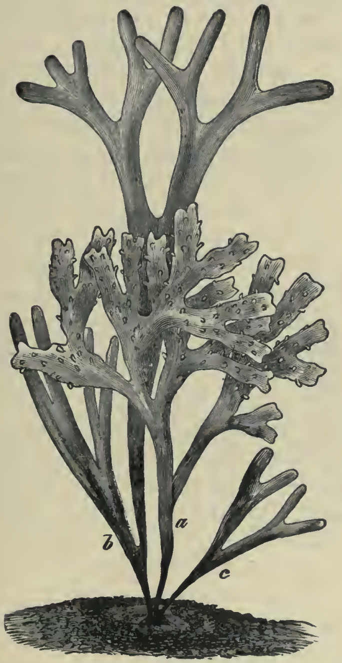


Fig. 2.—*Gigartina mamillosa: a*, narrow form, with fruit; *b*, large form; *c*, small form.

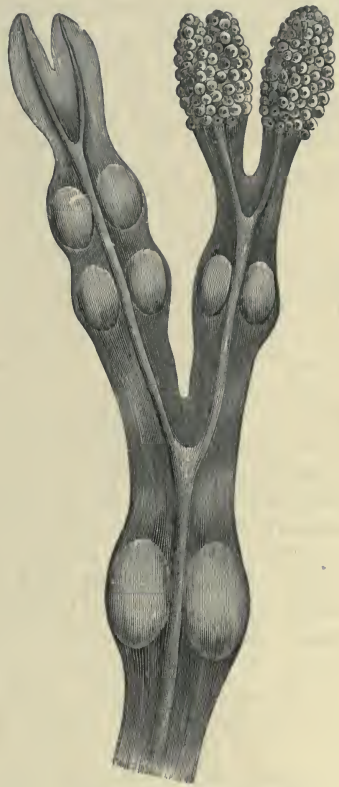


Fig. 3.—*Fucus vesiculosus:* fruiting branch, natural size.

Mucilage.—A kind of pectin called carrageenin, 9 p. c. of which is soluble in cold, nearly all in hot water; it differs from gum by alcohol not precipitating the aqueous solution, from starch by not turning blue with iodine, from pectin by not precipitating with lead acetate, and yielding no mucic acid with nitric acid; with diluted sulphuric acid yields galactose (sugar); has only slight adhesive properties, but sometimes is substituted in its three forms, *white, yellowish, yellow,* for acacia, under the name of "imitation gum arabic."

Minerals.—These are the chlorides, sulphates, phosphates (traces of iodides and bromides) of sodium, potassium, calcium, and magnesium.

Preparations.—(Unoff.): *Decoction*, 5 p. c. (water or milk), dose, ℥j–2 (30–60 Ml. (Cc.)). *Mucilage*, 3 p. c., mostly as an emulsifier. *Gelatin.* Any of these may be sweetened and flavored with lemon juice, etc., to one's pleasure. By macerating 10 minutes in cold water, throwing liquid away, then boiling with fresh water for 15 minutes, we get a solution free from any unpleasant flavor of saline or other foreign substances.

Properties.—Demulcent, nutrient, dietetic.

Uses.—Bronchitis, dysentery, diarrhœa, kidney and bladder affections, scrofula. Sheet gelatin is substituted for poultices by wrapping in flannel and moistening; may also be used as a diet wherever tapioca, sago, or barley is desired.

Related Product:

1. **Agar.** Agar, *official*.—(Syn., Agar-agar, Jelly Plant, Corsican (Worm) Moss, Crow-silk, Japanese (Chinese, Bengal, Ceylon) Isinglass, Gelatin; Fr. Mouse de Corse; Ger. Wurmmoss, Wurmtang). The dried mucilaginous substance extracted from *Gracila'ria* (*Sphærococ'cus*) *lichenoi'des*, Greville, + other marine algæ (*Gelid'ium*, *Gloiopel'tis* species) growing along the eastern coast of Asia.

Manufacture: Algæ are spread out, May–August, on the ground in thin layer, sprinkled repeatedly with water, kneaded by hands and feet, placed in baskets, washed thoroughly by immersion in water, spread out evenly in thin layer on straw, rush mats, shallow trays to bleach and dry. Agar, mostly in bundles, .4–.6 M. (16–24′) long, consisting of thin, translucent, membranous, agglutinated pieces, 4–8 Mm. ($\frac{1}{6}$–$\frac{1}{3}$′) broad, yellowish-brownish-white, shiny, tough (damp), brittle (dry); odor slight; taste mucilaginous, insoluble in water, slowly soluble in hot water. Powder, pale buff; microscopically—transparent granular fragments (occasionally frustules of diatoms) with iodine T. S.—bright red + bluish-black areas. *Tests:* 1. Solution in hot water (1 in 100)—stiff jelly upon cooling; incinerate—ash 5 p. c. 2. Hot aqueous solution (.1 in 100) upon cooling, + tannic acid T. S.—no precipitate (abs. of gelatin); + iodine T. S.—not blue (abs. of starch). *Impurities:* Foreign frustules, gelatin, starch, etc.

Properties and Uses.—Demulcent, emulsifyer; chiefly to form a solid medium (culture media) for artificial cultivation of bacteria and other organisms; soups, etc.; poor substitute for sodium stearate in suppositories, as it absorbs only 70 p. c. of glycerin, and melts at higher than body temperature. Native "Kanten" and "Fenori," are also from related algæ, being used to impart gloss to textiles, silk, stiffening linen (starch), decorating china, plastering walls, sizing, glue, etc.; granular form recommended as an aperient (ʒj; 4 Gm.).

Allied Plants:

1. *Gigartina acicula'ris* and *G. pistilla'ta.*—Both have appearance and properties similar to the official.

2. *Fu'cus vesiculo'sus, Bladder-wrack.*—Atlantic Ocean. Grows on muddy rocks and often floats to the shore; it is 1 M. (40′) long, 15 Mm. ($\frac{3}{5}$′) broad, flattened, branched, with a midrib. Air vessels in pairs, blackish, odor seaweed-like, taste mucilaginous, saline. *F. nodo'sus* is narrow, without midrib, air vessels single, otherwise similar; contains organic matter (mainly mucilage with little mannite, fat, etc.) 62 p. c., volatile oil (trace), moisture 22 p. c., ash 25 p. c.—chlorides, bromides, iodides, phosphates, sulphates (sodium, potassium). Alterative, in obesity. Dose, ℥ij (8 Gm.), in decoction; fluidextract (75 p. c. alcohol).

3. *Dulse* (*Halyme'nia* (*Fucus*) *palma'tus* and *H. ed'ulis*).—Atlantic and Mediterranean coasts; blood-red—when dry dark purple, fronds flat.

4. *Ceylon Moss.*—Indian Ocean. Mostly *Sphærococ'cus lichenoi'des,* 10 Cm. (4′) long, 1.5 Mm. ($\frac{1}{16}$′) thick, cylindrical, forked, filiform above; reddish—when dry whitish, brittle.

5. *Corsican Moss.*—Mediterranean. A mixture of 20–30 different Algæ species, mainly *Sphærococcus* (*Fucus*) genus; these are yellowish-brown.

CLASS 2. **FUNGI.**

2. HYPOCREACEÆ. Flesh-consuming Family.

Hy-poc-re-a'se-e. L. fr. Gr. ὑπο, under, through, by, + κρέας, flesh—*i. e.*, some of the species live upon meat (caterpillars and other insects). Exist mostly upon dead organic matter, sometimes upon living plants and insects; rarely with chlorophyll, mycelium inconspicuous, frequently producing a dense homogeneous tissue; ascocarps complex and either open from the first or at a later period; conidium formation occurs in many ways both from the mycelium and stoma; temperate climates; hæmostatic, ecbolic, poisonous.

Genus: **1. Claviceps.**

ERGOTA. ERGOT.

Claviceps purpurea, (*Fries*) *Tulasne.* The carefully dried sclerotium, replacing the grain of rye, *Secale cereale,* with not more than 5 p. c. of seeds, fruits, foreign matter.

Habitat: Eastern countries, Russia; cultivated in Spain, Germany, France.

Syn. Ergot of Rye, Spurred Rye, Cockspur Rye, Smut of Rye, Mother of Rye, Hornseed, Secale Clavatum, Mater Secalis, Clavus Secalinus; Fr. Ergot de Seigle, Seigle Ergoté (noir), Blé Cornu; Ger. Secale cornutum, Mutterkorn, Zapfen-, Hunger-korn.

Er'go-ta. L. fr. Fr. *ergot, argot,* a spur—*i. e.*, its spur shape.

Clav'i-ceps. L. *clava,* a club—*i. e.*, shape of the mycelium or sclerotium.

Pur-pu're-a. L. *purpureus,* purple colored—*i. e.*, the purple claviceps—color of the sclerotium.

Scle-ro'ti-um. L. fr. Gr. σκληρός, hard—*i. e.*, a hard body formed by certain fungi.

Se-ca'le. L. *secare,* to cut, or Celtic, *sega,* a sickle—*i. e.*, grain curved like a sickle, or the grain has to be cut down.

Ce-re-a'le. L. *cerealis,* cultivated grain.

Plant.—Rye: culm 1.5–2 M. (5–6°) high; leaves .25–.5 M. (10–20′) long, upper surface rough; spike 10–15 Cm. (4–6′) long, 2-sided, 2-flowered spikelet, June; fruit July; seed (grain) oblong, grooved on upper side, hairy at summit, brownish. Sclerotium (ergot), cylindraceous, obscurely 3-angled, fusiform, obtuse, somewhat curved, 1–4.5 Cm. (⅖–1⅘′) long, 3–5 Mm. (⅛–⅕′) thick, purplish-black, longitudinally furrowed; fracture short, pinkish; odor peculiar, disagreeable, free from mustiness; taste oily, disagreeable. Powder, grayish-brown: microscopically—chiefly fragments of false parenchyma of compacted hyphæ, few of outer layer of the sclerotium; mounts in hydrated chloral T. S. or sulphuric acid show many globules of fixed oil and yellowish, reddish fragments. *Tests:* 1. Bruise, add hot water—no ammoniacal or rancid odor. 2. Shake 1 Gm. + water (20) + 1 drop of hydrochloric acid, make 4 Ml. (Cc.) alkaline with ammonia water, shake out with 10 Ml. (Cc.) of ether; underlay 5 Ml. (Cc.) of this ethereal solution with 2 Ml. (Cc.) of sulphuric acid—blue ring at zone of contact. Ergot that breaks with a sharp snap, devoid of pinkish fracture, hard, brittle between the teeth, odorless and tasteless, should be rejected. Should be dried at 70° C. (158° F.) before storing, and kept dark, in tightly-closed containers, adding occasionally a few drops of chloroform or carbon tetrachloride to prevent insect attack; usually unfit for use after a year. *Solvent:* diluted alcohol. Dose, gr. 15–60 (1–4 Gm.).

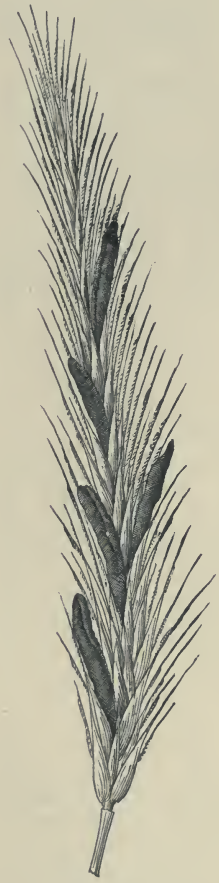


Fig. 4.—Ergotized rye.

Commercial.—Rye is to Russia what corn is to America, its bread approximating nearer that of wheat than any other grain. The origin of the sclerotium is the biennial thallophyte (fungus) *Claviceps purpurea*, parasitic during moist seasons on the ovary of grains, grasses, sedges—Carex, Cyperus species, etc. (that of rye alone being collected for medicine),—the development having three stages: 1, *mycelial*—when blooming a few ovaries in some grain heads become covered with sweet, yellow mucus, *honey-dew of rye*, whose disagreeable odor repels bees, but attracts ants, beetles, and flies—the once supposed cause of the diseased grain, but now known only to aid its dissemination and thereby the spreading of the disease; the filamentous cells (hyphæ), collectively forming the mycelium, spread over the lower portion of the ovary and cause decomposition of ovarian tissue, production of honey-dew (sugar), and innumerable reproductive bodies (conidia) imbedded therein; 2, *sclerotial*—when this conidial formation is at its height the mycelium ceases its superficial growth, presses into the ovary and begins to form a denser tissue at its base and central portion, and, growing upward, ruptures it and develops into a purplish-black, horn-like body, sclerotium (official ergot)—the dormant or resting form of the fungus; 3, *thalloidic*—when in the following spring ergot sprouts in many heads (stromata), consuming its fixed oil and other constituents, and becoming shriveled and worthless; have formed upon the head's surface spherical-topped excrescences, size of small pin's head, containing the orifices of flask-shaped cavities (conceptacles, perithecia) from whose base many cells (spore-sacs, asci) arise, each containing 8 filiform spores formed synchronous with rye flowers, so that the two (spores, flowers) acting together develop again the sphacelia (sclerotium), hence the necessity of using fresh ergot in medicine, at the end of the second stage, prior to the beginning of the third.

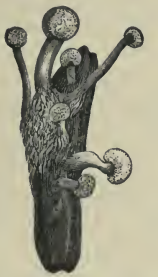


FIG. 5.—Ergot, with fruit heads.

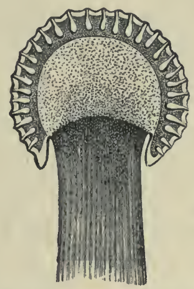


FIG. 6.—Longitudinal section of fruiting head, showing conceptacles.

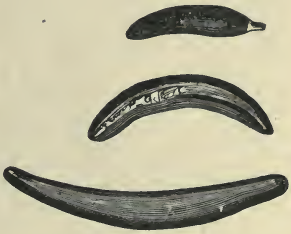


FIG. 7.—Ergota.

Ergot must be dried (too much causing injury, too little mouldiness) and stored (very dry, in well-stoppered bottles) with great care, as the fixed oil soon inclines to become rancid, and a mite ofttimes will attack it, in either case rendering the product worthless. This deterioration may be prevented largely by either (1) deoleation—extracting fixed oil with ether or petroleum benzin, drying, (2) adding occasionally a few drops of chloroform to the closed container, (3) suspending in the container a tube of potassium sulphate saturated with formaldehyde, (4) keeping over unslaked lime, (5) coating with ethereal solution of Tolu or (6) mixing powdered drug with benzoin (5 p. c.); in any event only the preservation of the sclerotium (entire) can be relied upon. There are three varieties: 1, *Spanish*, largest, finest-looking, highest-priced, bluest; 2, *Russian*, reddish-purple, considered most active; 3, *German*, reddish-purple.

CONSTITUENTS.—Alkaloids .38–.6 p. c.: Ergotoxine, Parahydroxyphenylethylamine, Isoamylamine, Ergamine, Enzymes (2). Fixed oil 30 p. c., sclererythrin (coloring matter), scleromucin (mucilage);

ergotininic acid, clavine, ergotinine, all three more or less inactive; ash 5 p. c. Such names as cornutine, sphacelotoxine, ergotinic acid, etc., only represent indefinite substances and should be abandoned.

Ergotoxine.—This, the essential active constituent, produces the true therapeutic effect of ergot (bluing of the cock's comb, contracting uterus, etc.): it is amorphous, but forms crystalline salts, phosphate, sulphate, tartrate, suitable for hypodermic injection; its presence in the other constituents often contribute its marked properties; action may largely be due to the amino group, in which fresh ergot is richest —just before rye is ripe.

Para-hydroxyphenylethylamine.—This and other amines (ammonia from putrefaction) may stimulate the uterine muscular wall and raise blood-pressure, but serve chiefly as synergists to the action of ergotoxine.

Enzymes.—These (one diastasic, the other hydrolyzing fats) rapidly deteriorate and reduce the physiological activity of ergot that has been dried slowly and imperfectly, forming a rancid, fatty odor (trimethylamine); both enzymes lose hydrolytic power by prolonged keeping or complete drying of the ergot, hence the necessity of proper care in this process.

Fixed Oil.—This is a dark brown liquid containing oleic acid 68 p. c., oxyoleic acid 22 p. c., palmitic acid 5 p. c., sp. gr. 0.925, and when removed by ether or petroleum benzin the ergot retains full alkaloidal strength which remains unimpaired for years if kept with care.

PREPARATIONS.—1. *Extractum Ergotæ.* Extract of Ergot. (Syn., Ext. Ergot., Extractum Hæmostaticum; Fr. Extrait d'Ergot de Seigle; Ger. Extractum Secalis cornuti, Mutterkornextrakt.)

Manufacture: Percolate 100 Gm. with purified petroleum benzin q. s. to remove fixed oil, discard benzin percolate, dry ergot, moisten with 85 p. c. alcohol 40 Ml. (Cc.) + hydrochloric acid 1 Ml. (Cc.), macerate, percolate with 85 p. c. alcohol until exhausted, reclaim alcohol, evaporate residue at 70° C. (158° F.), frequently stirring, to pilular consistence. Dose, gr. 2–10 (.13–.6 Gm.).

2. *Fluidextractum Ergotæ.* Fluidextract of Ergot. (Syn., Fldext. Ergot., Fluid Extract of Ergot; Br. Extractum Ergotæ Liquidum; Fr. Extrait fluide d'Ergot de Seigle; Ger. Extractum Secalis cornuti fluidum, Mutterkornfluidextrakt.)

Manufacture: Moisten, macerate for 6 hours in tightly-covered container 100 Gm. with enough 1st menstruum (diluted alcohol 98 Ml. (Cc.) + hydrochloric acid 2), pack, macerate, percolate, proceeding with 2nd menstruum (diluted alcohol) until exhausted; reserve first 85 Ml. (Cc.), reclaim alcohol from remainder, evaporate to soft extract, which dissolve in the reserve, mix thoroughly, add 2nd menstruum q. s. 100 Ml. (Cc.). Dose, ♏xv–60 (1–4 Ml. (Cc.)).

Unoff. Preps.: Aqueous Extract (chloroform water q. s., + alcohol 100), 200 p. c. *Infusion* (Br.), 5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)). *Tincture*, 15 p. c. *Tinctura Ergotæ Ammoniata*, 25 p. c., dose, ʒss–1 (2–4 Ml. (Cc.)). *Wine*, 20 p. c. (fluidextract, + alcohol 5, white wine 75), dose, ʒj–3 (4–12 Ml. (Cc.)). Ergotin (Bonjean's—aqueous extract deprived of scleromucin by precipitating with alcohol, filtering, evaporating), dose, hypodermically, gr. ¼–5 (.016–.3 Gm.).

PROPERTIES.—Emmenagogue, ecbolic, parturient, astringent, hæmostatic, excitomotor, poisonous. Value depends upon (1) bluing (gangrene of the cock's comb, (2) contracting the uterus, (3) raising the blood-pressure: contracts all unstriped (involuntary) muscle, especially uterus and intestine, expelling their contents. Depresses heart muscle, hence slows pulse, contracts arterioles (hæmostatic), thus increasing arterial pressure; diminishes sweat, saliva, milk, urine. In large doses gastro-intestinal irritant, causes nausea, vomiting, colic, thirst, purging, convulsions, "acute ergotism," or by many small doses may have "chronic ergotism;" this last may be in two forms: 1. Convulsive, causing tetanoid spasms of the flexors, respiratory muscles, death by asphyxia. 2. Gangrenous, causing cold, numb limbs, loss of sensibility, gangrene of lower extremities, buttocks, etc., epileptic convulsions, coma, death.

USES.—In labor to increase the power and duration of uterine contractions; these are continuous while natural labor-pains are intermittent, hence ergot is dangerous in thoughtless hands. Should never be used until after head is born, when it simply promotes firm uterine contraction; it is still wiser to withhold it until after birth, to prevent post-partum hemorrhage and aid uterine contraction (fluidextract ʒj (4 Ml. (Cc.)) by mouth or, better, hypodermically). Used also in chronic metritis, dysmenorrhœa, menorrhagia, fibroids, polypi, plethoric amenorrhœa, atonic spermatorrhœa, atonic arterial hemorrhage (males and females), spinal congestions, splenic enlargement, lax sphincters, incontinence of urine, aneurisms, diabetes. Externally to hemorrhoids.

For hypodermic injection—employ "Ergot Aseptic," or "Ergone," or solid extract deprived of alcohol and dissolved in water—introduce near seat of trouble; results here much better than by mouth; should have bladder and bowels freely open. The ergot formed on grasses is often sufficient to cause grazing animals to abort, and flour made of grain containing much of it will also sometimes act medicinally.

Poisoning: Have gastric disturbance, vomiting, diarrhœa, thirst, burning pain in feet, tingling in fingers, cramps in extremities, dilated pupils, cold surface, dizziness, small and feeble pulse, convulsions. Evacuate stomach (pump, emetics, purgatives), use tannic acid, stimulants, amyl nitrite (inhalation), strychnine, digitalis, friction, hot baths.

Incompatibles: Cardiac and motor depressants (aconite, veratrum, lobelia, etc.), caustic alkalies, metallic salts.

Synergists: Digitalis, belladonna (circulation), strychnine (nerves), ustilago, cotton root bark, hydrastine, emmenagogues.

Allied Plants:

1. *Ustila'go May'dis, Corn Smut.*—The fungous growth upon *Zea Mays*, official 1880–1890; United States, etc. The fungus is abundant upon stem, grains, and tassel; in irregular, globose masses 10–15 Cm. (4–6′) broad, consisting of a blackish, gelatinous membrane

enclosing many blackish, globular, nodular spores; odor and taste disagreeable. Should be kept dry and not longer than one year; contains fixed oil 2.5 p. c., sclerotic acid, crystalline principle (ustilagine) and alkaloid (secaline), volatile base, sugar, mucilage, ash 5 p. c. Used as emmenagogue, parturient, increases uterine pains during labor, like ergot. Dose, gr. 15–30 (1–2 Gm.).

2. *Saccharomy'ces* (*Tor'ula*) *cerevis'iæ, Fermentum* (*Yeast*).—A peculiar insoluble product of the fermentation of malt liquors produced by this fungus, official 1820–1840, 1860–1880. Yeast plant is unicellular, multiplies by budding, being produced during alcoholic fermentation of saccharine fluid, in 2 forms: 1. Top or surface yeast, most active, semi-fluid, frothy mass, odorous, cellular, fermenting in 3 or 4 days at 15–20° C. (59–68° F.). 2. Bottom or sediment yeast, works at 6–8° C. (43–46° F.), much slower, reproduces by isolated spores. Liquid yeast becomes hard, dry (yeast cake), retaining vitality a long time; contains enzymes or ferments—zymase, invertase, diastase, maltase, and yields upon analysis C 49.9 p. c., H 6.6. p. c., N 12.1 p. c., O 31.4 p. c., insoluble in alcohol, water, ceases to vegetate below 5° C. (41° F.), but will stand —60° C. (—76° F.) without being killed. Used as tonic, stimulant laxative, antiseptic poultices, for typhoid, diabetes, diarrhœa, scurvy, diphtheria, sores, bruises. Dose, ℥j–2 (30–60 Gm.); cerevisiæ fermentum compressum.

3. *Polyp'orus* (*Bole'tus*) *fomenta'rius, Agaric of the Oak* (*Touch Wood*).—The fungus, official 1830–1840; Europe, on *Quercus* and *Fagus* species. It is formed by an additional layer of fibres each year; is collected Aug.–Sept., and resembles the horse's hoof, being 15–25 Cm. (6–10′) wide. When young is soft, velvety, but becomes hard and ligneous; when deprived of outside ligneous portion, brownish above and yellowish-white beneath, porous, fibrous, tough, inodorous, tasteless; when for use is deprived of harder rind, sliced, boiled in lye, washed, beaten, until soft and pliable, then absorbs twice its weight of water; contains extractive, resin, nitrogenous matter, KCl, $CaSO_4$; the ash—Fe, Ca, Mg, phosphate. Used locally with pressure to arrest hemorrhage. Agaric steeped in nitre solution yields spunk or tinder. *Agaricin* (*Agaricinum*), $C_{16}H_{30}O_5 + H_2O$, is from *Polyp'orus officina'lis, Agaricus;* occurs in white crystals, sweet at first then bitter, soluble in alcohol. Antihydrotic; night-sweats of phthisis, sweating from coal-tar products and salicylates. Dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.). Agaricin contains agaricic acid, which is the active and better principle to use.

4. *Agar'icus musca'rius* (*Amani'ta musca'ria*), *Fly Fungus* (*Agaric*).—N. Europe, Russia. This mushroom grows in the autumn mainly, under pine trees; stalk is white, tuberous at base, 7.5–15 Cm. (3–6′) high, 1.8 Cm. ($\frac{3}{4}$′) thick. Cup (pileus) 10–15 Cm. (4–6′) broad, orange-red; contains chiefly *muscarine* (muscarina), $C_5H_{15}NO_3$, a colorless, odorless, crystalline, deliquescent alkaloid, yielding deliquescent salts (nitrate, sulphate); all usually occur as brown, syrupy liquids, soluble in water, alcohol; resembles Calabar bean in action; antihydrotic, antispasmodic, myotic. Reduces force and frequency of pulse,

contracts muscles of intestines and bladder, increases abdominal secretions, causes dyspnœa, paralysis, death. Given for intestinal torpor, duodenal catarrh, diabetes, antidote to atropine, to replace physostigmine. Dose (muscarine), gr. $\frac{1}{30}$–$\frac{1}{15}$ (.002–.004 Gm.).

5. *Cetra'ria islan'dica, Iceland Moss.*—Parmeliaceæ. The dried plant, official 1840–1900; N. hemisphere (N. America, etc.). Thallus 5–10 Cm. (2–4′) long, foliaceous, fringed, and channeled lobes, brownish above, whitish beneath, apothecia (fruits) brown, flattish, brittle, inodorous; taste mucilaginous, bitter; contains cetraric acid (bitter) 2–3 p. c., which removed leaves digestible food product containing proteids 2.8 p. c., fat .4 p. c., cellulose 4–6 p. c., lichenin (starch) 79.2 p. c., related substance, water 6 p. c., ash 6.99 p. c. Demulcent (starch), tonic (cetraric acid), nutritive; chronic catarrhs, pulmonary affections (bronchitis, consumption), chronic diarrhœa, dysentery; bread, instead of acacia. Dose, ʒss–1 (2–4 Gm.); decoction, 5 p. c., ℥j–4 (30–120 Ml. (Cc.)).

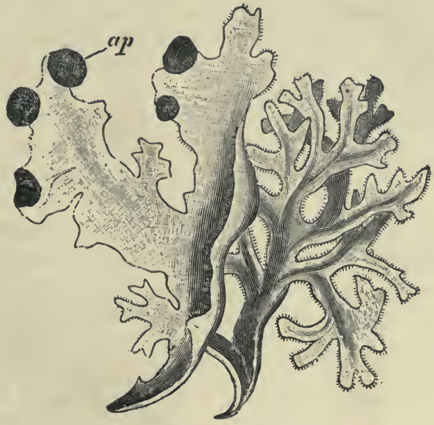


Fig. 8.—*Cetraria islandica: ap*, apothecium.

6. *Lecano'ra tarta'rea, Lacmus* (*Litmus*).—Holland. This is a blue pigment obtained from this and other lichens by powdering, mixing with potassium carbonate, water, and stale urine (or other ammoniacal liquid), then exposing to the air for fermentation. The liquid turns gradually red, purple, and blue, when it is mixed with enough chalk to be formed into 12–25 Mm. (½–1′) rectangular cakes—requires 6 weeks; chiefly produced in Holland. By slightly different processes on the same lichens we obtain the allied pigments, orchil and cudbear. Litmus is used as an indicator to determine the acidity or alkalinity of urine and other animal fluids—acids turning it red, alkalies blue; orchil is a deep purple, pasty mass, used as a dye; cudbear (persio) is a purplish-red powder, used as a dye and to color various medicinal preparations; tincture (75 p. c. alcohol) 10 p. c.; compound tincture 1.5 p. c., caromel 10 p. c.

SUB-KINGDOM II. **PTERIDOPHYT(ES)-A.**

Vascular cryptogams (ferns), mostly terrestrial; stems, roots, leaves, woody fibres, and vessels well developed, spores go into flat or irregular prothallia bearing antheridia and archegonia.

CLASS 3. **FILICINÆ.**

3. POLYPODIACEÆ. Fern Family.

Pol-i-po-di-a′se-e. L. *Polypodi-um* + aceæ, fr. Gr. πολύς, many, + πούς, ποδός, foot—many feet, rays—*i. e.*, from the branched rootstocks of some species. Includes nine-tenths of our ferns, being the typical family. Herbaceous with a permanent stem, which is usually prostrate or subterranean. Fronds large, simple, pinnate, pinnatifid or decompound, coiled in vernation; numerous sporangia, on the underside or margins, in clusters (sori). Sori with or without membranaceous covering (indusium), prothallium green; universal, bitter, astringent, anthelmintic, mucilage, tonic.

Genus: **1. Dryopteris.**

ASPIDIUM. ASPIDIUM.

Dryopteris { **Filix-mas,** (*Linné*) *Schott,* { The dried rhizome and stipes,
marginalis, (*Linné*) *Gray.* without roots, dead portions.

Habitat. 1. N. America, N. Asia, Europe, N. Africa. (Canada, westward to Rocky Mountains, Mexico, S. America, Andes, Himalaya Mountains, Polynesian Islands.) 2. N. America, southward to N. Carolina; mountains.

Syn. Male Fern, Male Shield Fern, Bear's Paw Root; Sweet Brake, Knotty Brake, Shield Root; Br. Filix Mas, Radix Filicis maris; Fr. Fougère mâle; Ger. Rhizoma Filicis, Farnwurzel, Wurmfarn, Waldfarn, Johanniswurzel.

Dry-op′te-ris. L. fr. Gr. 'δρυοπτερίς — δρυός, of the oak, growing among trees, in thickets, + πτέρις, a feather, wing or fern—*i. e.*, their favored place of growth.

Fil′ix-mas′. L. *filix*, a fern, fr. Gr. πτέρις a fern, frond, etc., + *mas*, male—*i. e.*, referring to its asexual fructification.

Mar-gi-na′lis. L. *margo*, *marginis*, margin—*i. e.*, the fruit dots are near the edge of the frond.

As-pid′i-um. L. fr. Gr. ασπίδιον, a little shield—*i. e.*, shape of the indusium.

PLANTS.—Perennials; fronds .3–1 M. (1–3°) high or long, bipinnate, pinnæ lanceolate, circular fruit dots situated on the veins, in the first species near the midrib, in the second near the margin, covered by a heart-shaped indusium. RHIZOME, horizontal, 15–30 Cm. (6–12′) long, 5–7.5 Cm. (2–3′) thick, covered with stipe-bases, "fingers," which remain green several years and often constitute the greater bulk of the official drug; when peeled (deprived of stipes, roots) the rhizome itself is 7.5–15 Cm. (3–6′) long, 1–3 Cm. ($\frac{2}{5}$–$1\frac{1}{5}$′) thick, cylindraceous, straight, curved, tapering to one end, usually split longitudinally, roughly scarred with remains of stipe-bases, or bearing several coarse longitudinal ridges and grooves; stipes cylindrical, 3–5 Cm. ($1\frac{1}{5}$–2′) long, 6 Mm. ($\frac{1}{4}$′) thick, straight, curved, tapering to one end, occasional elongated patches of blackish-brown outer layer; fracture short, pale green (inner half), texture rather spongy, exhibiting 12 (*D. Filix-mas*) or 6 (*D. marginalis*) vascular bundles (steles), in interrupted circle, each surrounded with an endodermis; odor slight; taste sweetish, astringent, bitter, acrid. Powder, greenish, brownish—must be prepared freshly. Should be kept dark, in tightly-closed containers. *Solvents:* alcohol; acetone; ether—extracting filicic acid, filicin, volatile oil, resin, chlorophyll, fixed oil, all occurring in the official oleoresin. Dose, ʒss–2 (2–8 Gm.).

Adulterations.—Rhizomes of many indiginous ferns (chiefly *Osmuda* species) resembling the official, although such are thinner, free from chaff, and have stipes rarely closely imbricate, but when peeled and mixed practically defy detection; composition and properties are less subject to change in the unpeeled, while adulterations are recognized more easily; carelessness often renders the drug unreliable.

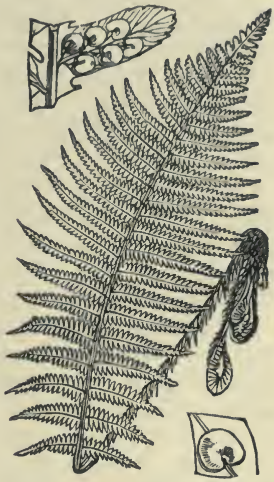


Fig. 9.—*Dryopteris Filix-mas.*

Commercial.—The "uncomminuted rhizome" covered with stipes (fingers) should be collected when strongest, autumn, freed from roots and dead portions of rhizome and stipes (only such parts being retained as have green fracture), dried at 70° C. (120° F.), and quickly made into preparations, as it deteriorates rapidly, usually becoming inert in 1–2 years; soil and climate have greater influence upon amount of filicic acid than time of collection, etc., the richest yield being from plants growing on strata of volcanic origin.

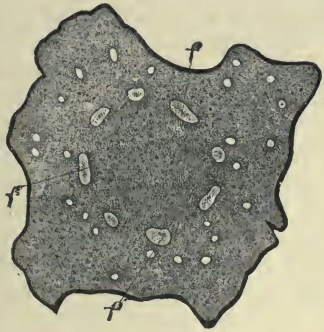


Fig. 10.—Filix-mas: transverse section magnified 3 diam.; *f*, fibrovascular bundles.

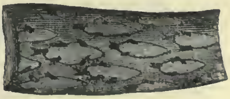


Fig. 11.—Filix-mas; surface of peeled rhizome.

Constituents.—Filicic acid 5–10 p. c., Filicin 19–31 p. c. (rohfilicin), fixed oil 6–7 p. c., filitannic acid 10 p. c., filix red, chlorophyll, volatile oil, 2 resins, ash 3 p. c. Böhm isolates aspidin (2–3 p. c.), albaspidin, aspidinin, aspidinol, and flavaspidic acid, and claims virtue to be chiefly in aspidin and filicic acid combined; Kraft and Jaquet believe the virtue to reside in filmaron. Dose, gr. 7–10 (.5–.6 Gm.).

Filicic (Filicinic) Acid, $C_{35}H_{42}O_{13}$.—Most active constituent, white, amorphous or crystalline, tasteless, more soluble than its anhydride, poisonous. Dose, gr. 10–20 (.6–1.3 Gm.).

Filicin (Filicic Anhydride), $C_{35}H_{40}O_{12}$.—Yellowish-white, nonpoisonous, inactive, crystalline, soluble in most solvents except aqueous; yields with fusing potassium hydroxide butyric acid and phloroglucin.

Preparations.—1. *Oleoresina Aspidii.* Oleoresin of Aspidium. (Syn., Oleores. Aspid., Oleoresin of Male Fern, Oil of Fern; Br. Extractum Filicis Liquidum, Oleum Filicis Maris; Fr. Extrait (oléo résineux) de Fougère male; Ger. Extractum Filicis, Farnextrakt, Wurmfarnextrakt, Wurmfarnöl.)

Manufacture: Percolate slowly, in a covered glass percolator, 100 Gm. with ether, added in successive portions, until exhausted, reclaim most of the ether on water-bath, transfer residue to a dish, allow remaining ether to evaporate spontaneously in a warm place; yield 10–15 p. c. (acetone 18 p. c.). This contains filicic acid 5–10 p. c., some of which deposits in granular crystals on standing, and must be mixed thoroughly with the liquid portion before dispensing. Should be kept in well-stoppered bottles. Dose, ʒss–1 (2–4 Ml. (Cc.)), every 3 hours; death has occurred from ʒvj (24 Ml. (Cc.)).

Unoff. Preps.: Extract, dose, gr. 15–30 (1–2 Gm.). *Fluidextract*, dose, ʒj–2 (4–8 Ml. (Cc.)).

Properties.—Tænifuge, tonic, astringent.

Uses.—This was known to the ancients as a vermifuge, being mentioned by Dioscorides, Galen, Pliny, Theophrastus, etc. In 1775 the King of France bought and made public this then secret tapeworm remedy from the Swiss surgeon Nouffer's widow.

When requiring this medicine the patient should fast the previous day, being nourished by only a little bread and milk; at night take ℥j (30 Ml. (Cc.)) of castor oil, to expel nidus, and on the following morning a full dose of oleoresin, still fasting; in 3 hours may repeat the dose. At noon may begin moderate eating, and at night should be given another cathartic—not castor oil, as it may aid absorption, but full dose of calomel, jalap, gamboge, Epsom salt, or saline enemas, to clear away the dead worm.

Allied Plants:

1. *Dryopteris rig'ida* (*Aspidium rig'idum*).—S. Europe, California. Rhizome longer, thinner, with 6 vascular bundles. *D. athaman'tica* (*A. athaman'ticum*); S. Africa. Rhizome thicker, firmer than official, inside brownish, with black resin dots, broader vascular bundles.

2. *Osmun'da rega'lis, Flowering Fern, Adian'tum peda'tum, Maidenhair* and *Polypo'dium vulga're, Common Polypody.*—All used for chronic catarrh, asthma, pectoral demulcent, tonic.

CLASS 4. LYCOPODINÆ.

4. LYCOPODIACEÆ. Club-Moss Family.

Li-ko-po-di-a′se-e. L. *Lycopodi-um* + aceæ, fr. Gr. λύκος, a wolf, + πούς, ποδός, a foot—*i. e.*, from appearance of the shoots to a wolf's foot. Herbs resembling mosses. Distinguished by creeping stems, corms; leaves small, sessile, 4–16 ranks; sporangia in axis of leaves or scales, 1–3-celled, often reniform, 2-valved, containing many yellow spores, of one kind only, marked at summit with 3 radiating lines; prothallia subterranean, with or without chlorophyll; monœcious; universal; emetic, purgative, aphrodisiac, acrid principle poisonous, some spores inflammable.

Genus: **1. Lycopodium.**

LYCOPODIUM. LYCOPODIUM.

Lycopodium clavatum, *Linné.* { The spores, with not more than 2 p. c. of impurities.

Habitat. Europe, Asia, N. America, in dry woods.

Syn. Lycopod., Club Moss, Clubfoot Moss, Running Moss, Snake (Staghorn) Moss, Ground (Running) Pine, Wolf's Claw, Fox Tail; Vegetable Sulphur (Brimstone), Semen Lycopodii; Fr. Lycopode, Soufre végétal, Pied de Loup; Ger. Bärlappsporen, Hexenmehl, Streupulver, Blitzpulvre.

Ly-co-po′di-um. L. see etymology, above, of Lycopodiaceæ.

Cla-va′tum. L. *clavatus*, club-like—*i. e.*, alluding to club-like appearance of the fertile spikes.

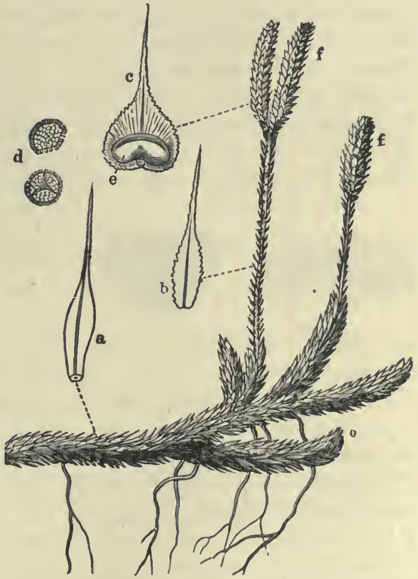


FIG. 12.—*Lycopodium clavatum: o*, a fragment of stem with spore-bearing spikes, *f, f; a*, leaf of stem; *b*, leaf of fertile branch; *c*, cone scale (bract) showing sporangium *e*; *d*, spores.

PLANT. — Low creeping perennial; stem .6–3 M. (2–10°) long, slender, tough, flexible, woody; branches ascending, leafy, the fertile terminated by a slender peduncle 10–15 Cm. (4–6′) long, with 1–2 linear, cylindrical spikes—thecæ, cones, capsules, 2.5–5 Cm. (1–2′). long; leaves linear, awl-shaped, 6 Mm. (¼′) long, dense, light green, tipped, as are also the numerous bracts, on the flowering spikes with a fine bristle; in axils of bracts have the kidney-shaped sporangia containing the spores. SPORES, a light yellow, very mobile powder, nearly inodorous and tasteless, not wetted by water, floats upon it, but sinks when boiled with it; when thrown into a flame burns with a quick flash; microscopically—spherical tetrahedrons, .025–.04 Mm. $(\frac{1}{1000}-\frac{1}{625}{}')$ broad, plano-convex, triangular, outer wall (exosporium) extended in slight, irregular projections, giving the surface a reticulated appearance, the reticulations being polygonal and formed of straight sides; when rounded surface downward, the upper surface is characterized by a distinct, triangular marking, being the edges of the three straight surfaces from the centre to near the outer edge; few if any pine pollen, .04–.07 Mm. $(\frac{1}{625}-\frac{1}{360}{}')$ broad, consisting of three parts, in which a central, convex, generative cell separates the two spherical cells or wings, that are blackish due to inclusion of air.

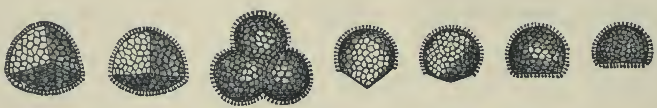


Fig. 13.—Lycopodium.

Adulterations.—1, Pollen of many Pinaceæ (*Pinus sylvestris*, *P. palustris*, etc.), less fine and mobile, and mixes more easily with water than lycopodium; 2, Talc, gypsum, ferruginous earth, sand, increasing the ash beyond 3–5 p. c., and quickly subsiding when shaken with carbon disulphide, chloroform, or water; 3, Starch, flour (sometimes 25 p. c.), blue with iodine T. S., sinking in carbon disulphide; dextrin, soluble in water, when concentrated precipitated by alcohol; sulphur, dissolves in carbon disulphide, remaining upon evaporation; rosin, treat with alcohol, evaporate the tincture; turmeric, reddish-brown with alkalies.

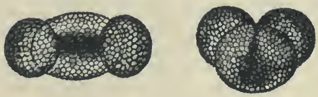


Fig. 14.—Pollen of pine.

Commercial. — Lycopodium comes chiefly from *L. clavatum*, but considerable from *L. complana'tum*, *L. annot'inum*, and *L. inunda'tum*, being obtained by cutting off the tops when fruit spikes (cones) are nearly ripe, shaking out spores from sporangia, and sifting; collected mostly, July–August, in Russia, Germany, Switzerland.

Constituents.—Fixed oil 47–49 p. c., cane-sugar 2 p. c., volatile base (methylamine), ash 3–5 p. c. (sand + 1 p. c. P_2O_5). The substance of the cell-wall is called pollenin; when treated with potassium hydroxide gives yellow color, becoming blue upon the addition of sulphuric acid and iodine. The oil, similar to expressed oil of almonds, contains palmitic, stearic, myristic, and oleic acids—the latter 80 p. c. being slightly abnormal.

Properties.—Once considered diuretic, antispasmodic for rheumatism, epilepsy, pulmonary and renal disorders, dysentery.

Uses.—Externally to protect tender and raw surfaces, erysipelas, eczema, herpes, ulcers, chafing in infants; in pharmacy as a basis for insufflations, also to prevent adhering of pills, suppositories, etc. Popular "homeopathic medicine" (1 to 100 milk-sugar triturated till oil liberated); internally gives excited circulation, urinary irritation, often cures dyspepsia, flatulence, constipation, aneurism, diphtheria, mucous membrane affections of lungs and bronchi.

SUB-KINGDOM III. **SPERMATOPHYT(ES)-A (PHANEROGAMIA).**

Seed-producing plants, each containing a complete embryo, and includes the greatest number (120,000), as well as the highest forms of plants.

CLASS 5. **GYMNOSPERMÆ (Seeds naked, not enclosed in an ovary).**

5. PINACEÆ (CONIFERÆ). Pine Family, Conifers.

Pi-na'se-e. L. *Pin-us* + aceæ, fr. Celtic *pin, pyn,* a mountain, rock —*i. e.,* habitat of some species. Trees, evergreen shrubs. Distinguished by abounding in oleoresinous juice, leaves needle-shaped, entire, parallel-veined; flowers monœcious—staminate in catkins, without calyx or corolla—pistillate in cones; ovules naked, 2 or more on upper surface of each scape (carpel); fruit woody cone; seeds naked, cotyledons 2 or many, wood without ducts, with discoid markings; temperate climates; stimulant, diuretic, emmenagogue, anthelmintic, expectorant, timber.

Genera: **1. Pinus. 2. Juniperus.**

TEREBINTHINA. TURPENTINE.

1. **Oleum Terebinthinæ. Oil of Turpentine,** *official.*
2. **Resina. Rosin,** *official.*

Pinus palustris, *Miller,* and other species.	The volatile oil (1), and residue left (2) from distilling with water the concrete oleoresin (turpentine) obtained from this plant.

Habitat. S. United States, Virginia to Texas, near the coast.

Syn. Long leaved (Yellow Pitch, Broom, Pitch, Swamp, Georgia) Pine; Common Frankincense, Terebinthina Communis, Thus Americanum, Frankincense, Crude Turpentine: 1. Ol. Tereb., Turpentine Oil, Spirits of Turpentine; Fr. Térébinthine (du Pin) de Bordeaux; Essence de Térébenthine officinale; Ger. (Gemeiner) Terpentin; Terpentinöl: 2. Resin, Colophony; Fr. Résine blanche (jaune); Ger. Colophonium, Kolophonium, Geigenharz.

Pi'nus. L. see etymology, above, of Pinaceæ.

Pa-lus'tris. L. *paluster,* swampy—*i. e.,* it inhabits swamps or near marshy places.

Ter-e-bin'thi-na. L. *terebinthus;* Gr. τερέβινθος, of or from the *terebinth—turpentine tree.*

Tur'pen-tine, fr. *turbentine, terebinthine, terebinthina.*

PLANT.—Large tree, 18–30 M. (60–100°) high, .3–.6 M. (1–2°) thick; bark thin, scaled, furrowed; wood hard, resinous; leaves many, crowded at end of branches, in 3's, 25–40 Cm. (10–16′) long, very narrow, sharp-pointed, triquetrous, in clusters surrounded by a sheath 25 Mm. (1′) long; flowers sterile in violet aments, 5 Cm. (2′) long; Fruit cone, large, oblong, 15–25 Cm. (6–10′) long, scales armed with short spine. Oleoresin (terebinthina, turpentine—once official), in yellowish, opaque masses, brittle in the cold, lighter internally, sticky, more or less glossy; terebinthinate odor and taste; alcoholic solution gives acid reaction; rarely seen as yellow, opaque, viscid liquid.

CONSTITUENTS.—CONCRETE OLEORESIN: Volatile oil 20–30 p. c., Rosin (resina, resin) 50–60 p. c., bitter principle, formic, succinic, and possibly other resin acids—pinic and sylvic acids.

Oleum Terebinthinæ. Oil of Turpentine, $C_{10}H_{16}$. Obtained by distilling with water the concrete oleoresin (turpentine); it is a colorless liquid, characteristic odor and taste, both becoming stronger and less pleasant on aging or exposure (owing to formation of ozone, resin, formic and acetic acids), soluble in 5 vols. of alcohol, sp. gr. 0.865, dextrorotatory, with hydrochloric acid forms artificial crystalline camphor, $C_{10}H_{16}HCl$; contains chiefly *d*-pinene (French oil *l*-pinene), also derivatives of pinene, and often camphene and fenchene. *Tests:* 1. In distilling 200 Ml. (Cc.) from 300 Ml. (Cc.) 90 p. c. comes over between 154–170° C. (309–338° F.). 2. Shake 5 Ml. (Cc.) with equal volume of potassium hydroxide T. S.—not darker than light straw yellow on standing 24 hours; evaporate 5 Ml. (Cc.)—residue .1 Gm. 3. Expose to air 3 drops on unsized, white paper—evaporates entirely without permanent stain (abs. of fixed oils, etc.); shake vigorously with equal volume of hydrochloric acid—no brown or green color on standing a few minutes. Must be added to fuming acids drop by drop. *Impurities:* Fixed oils, petroleum (benzin), paraffin oils, kerosene, rosin (oil), etc. Should be kept in well-closed containers.

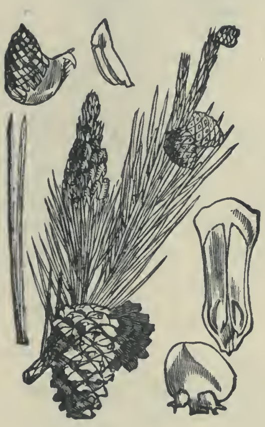


FIG. 15.—*Pinus palustris.*

ADULTERATIONS.—Tar oils, kerosene, petroleum benzin, paraffin oils, rosin oil, etc.

1. **Resina. Rosin.** This residue, left after distilling off the volatile oil from the concrete oleoresin (turpentine), is usually in sharp, angular, translucent, amber-colored fragments, frequently covered with a yellow dust, brittle at ordinary temperature; fracture shiny, shallow-conchoidal, odor and taste slightly terebinthinate; freely soluble in alcohol, ether, benzene, glacial acetic acid, fixed or volatile oils, dilute solutions of the fixed alkali hydroxides, sp. gr. 1.08, easily fusible, burning with dense yellowish smoke; alcoholic solution acid; contains anhydride of abietic acid $C_{44}H_{62}O_4$, 80–90 p. c., pinic and sylvic acids. *Tests:* 1. Shake with warm diluted alcohol—abietic anhydride converted

into abietic acid, $C_{44}H_{64}O_5$, crystalline, soluble in carbon disulphide, benzene, alcohol, ether, chloroform, alkalies, glacial acetic acid. 2. Boil with alkaline solution—greasy salts of abietic acid (rosin soap); distil with superheated steam—benzene and toluene; incinerate 2 Gm.—ash .05 p. c. The varieties depend upon color, and this upon degree of heat employed in distillation; the older the trees, the greater the yield of rosin, the smaller the yield of oil.

Commercial.—The *P. palustris* (*P. austra'lis*—*i. e.*, southern) grows in dry sandy soil from the sea to 100 miles (160 Km.) inland, the young trees resembling brooms, the older furnishing (chiefly in North Carolina, some in South Carolina, Georgia) most of the turpentine and rosin of commerce. The oleoresin secretes in the sapwood and sparingly exudes spontaneously, but to obtain it profitably on a large scale the trees are *boxed, cornered* and *chipped,* which consists in cutting with a special axe, during winter, in the tree trunk (beginning 20–30 Cm. (8–12′) above ground) 1–4 cavities of triangular shape, 30 Cm. (12′) wide, 15 Cm. (6′) high and deep, excavating downward so as to hold 4–8 pints (2–4 L.) (*boxing*), removing the bark above each box and hacking the exposed wood in shape of the letter L (*cornering, chipping*). The "crude" begins to flow the middle of March, running best July–August, slackening September–October, the boxes being emptied frequently, often 7 "dippings" a season, with "turpentine dippers or ladles," contents poured into barrels (250 pounds; 110 Kg.), and subsequently distilled; every few weeks the trees are hacked a little higher from ladders. The first year's flow is best, *virgin dip,* yielding 6½ gallons (24 L.) of oil per barrel and "window-glass rosin;" succeeding years give *yellow dip,* yielding 4 gallons (15 L.) of oil per barrel and medium grades of rosin; some hardens on trees, *scrapings, scrape,* yielding 2 gallons (7.5 L.) of oil per barrel and brownish-black rosin. The exudation may be caught in detachable earthen cups, "cup-and-gutter system," which should replace, partly or entirely, the present most destructive process that causes the trees to be exhausted and abandoned in about 5 years, otherwise the industry seems doomed. In France covered pails or cups with lips, to avoid evaporation, chips, bark, etc., are used, into which the sap flows by a gutter through comparatively small hacked spaces, which, when alternating 5 working with 2 resting seasons, insures a handsome yield for 2 generations. The comminuted wood has been distilled with water, steam, alkali, etc., but with questionable satisfaction.

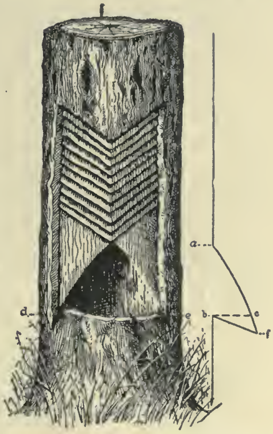


FIG. 16.—A boxed, cornered, and chipped pine tree.

In the distillation of concrete oleoresin, when the volatile oil ceases to come over, the resin (rosin) while hot is run off from the bottom of still and strained into barrels, while the condensed distillate (oil), floating above the water, is dipped out and barrelled for market.

PREPARATIONS. — I. OIL: 1. *Oleum Terebinthinæ Rectificatum.* Rectified Oil of Turpentine. (Syn., Ol. Tereb. Rect., Rectified Turpentine Oil; Fr. Essence de Térébenthine rectifiée; Ger. Gereinigtes Terpentinöl.)

Manufacture: Shake thoroughly oil of turpentine, a convenient quantity, with an equal volume of sodium hydroxide solution, recover about three-fourths of the oil by distillation, separate the clear oil from the water, dry it by shaking with anhydrous calcium chloride, filter. It is a colorless liquid, conforming to the properties and tests of oil of turpentine, sp. gr. 0.865; evaporate 5 Ml. (Cc.)—residue .015 Gm. Should be kept cool, in well-stoppered, amber-colored bottles, and dispensed when oil of turpentine is required for internal use. Dose, stimulant, diuretic, ♏v–30 (.3–2 Ml. (Cc.)); anthelmintic, ʒss–4 (2–15 Ml. (Cc.)), on sugar or emulsified.

Preps.: 1. *Emulsum Olei Terebinthinæ.* Emulsion of Oil of Turpentine. (Syn., Emuls. Ol. Tereb., Turpentine Emulsion; Fr. Emulsion d'essence de Térébenthine; Ger. Terpentinölemulsion.)

Manufacture: 15 p. c. Add to dry bottle acacia 15 Gm., then rectified oil of turpentine 15 Ml. (Cc.), expressed oil of almond 5 Ml. (Cc.), shake thoroughly, add water 30 Ml. (Cc.), shake vigorously; when emulsified add syrup 25 Ml. (Cc.), in several portions, shaking after each, finally add water, in divided portions, with shaking, q. s. 100 Ml. (Cc.). Dose, ʒj–8 (4–30 Ml. (Cc.)).

2. *Terpini Hydras.* Terpin Hydrate, $C_{10}H_{18}(OH)_2 + H_2O$. (Syn., Terpin. Hyd.; Fr. Dihydrate de térébenthène (terpilène); Terpinum hydratum, Terpinhydrat.)

Manufacture: This hydrate of the dihydric alcohol terpin is obtained by mixing in a shallow dish rectified oil of turpentine (4), alcohol (3), nitric acid (1), allowing to stand 3–4 days, collecting crystals, draining, drying on filter paper, recrystallizing from alcohol rendered slightly alkaline to remove adhering acid. It is in colorless, lustrous, rhombic prisms, nearly odorless, slightly aromatic (resembling fresh lilacs, but not turpentine); somewhat bitter taste, efflorescent in dry air; soluble in water (200), boiling water (34), alcohol (13), boiling alcohol (3), chloroform (135), boiling glacial acetic acid (1); hot, saturated aqueous solution not acid to litmus. *Tests:* 1. Heated slowly at 100° C. (212° F.)—sublimes in fine needles; quickly heated—melts at 116° C. (241° F.) with the loss of water; also loses water of crystallization slowly over sulphuric acid. 2. Hot aqueous solution with a few drops of sulphuric acid—turbid, developing a strongly aromatic odor; incinerate 2 Gm.—ash .05 p. c. Should be kept cool, in well-closed containers. Dose, gr. 2–15 (.13–1 Gm.); elixir, 1.75 p. c., ʒj–2 (4–8 Ml. (Cc.)); elixir with codeine; elixir with diacetylmorphine.

2. *Linimentum Terebinthinæ.* Turpentine Liniment. (Syn., Lin. Terebinth., Kentish's Ointment; Fr. Liniment Térébenthine; Ger. Terpintinliniment.)

Manufacture: 35 p. c. Dissolve rosin cerate 65 Gm., previously melted in a dish on a water-bath, in oil of turpentine 35 Gm.; mix thoroughly; used externally.

3. *Terebenum.* Terebene, $C_{10}H_{16}$. (Syn., Tereben.; Fr. Terebène; Ger. Tereben.)

Manufacture: This liquid, consisting of dipentene (chiefly) and other hydrocarbons (terpinene, cymol, camphene, etc.) is obtained by adding gradually sulphuric acid (1) to oil of turpentine (20), allowing to stand for 24 hours, removing supernatant layer, neutralizing with chalk, distilling, further rectifying with steam. It is a colorless, thin liquid, rather agreeable, thyme-like odor, aromatic, somewhat terebinthinate taste, soluble in alcohol (3), slightly in water; on exposure to light gradually becomes resinified and of acid reaction, sp. gr. 0.863, boils at 166° C. (331° F.). *Impurities:* Rosin, unaltered oil of turpentine. Should be kept dark, in well-closed containers. Dose, ♏v–15 (.3–1 Ml. (Cc.)).

Unoff. Prep.: Linimentum Terebinthinæ Aceticum (Br.), 44.5 p. c. (rectified oil), glacial acetic acid 11, liniment of camphor 44.5.

II. Rosin: 1. *Ceratum Resinæ.* Rosin Cerate. (Syn., Cerat. Res., Basilicon Ointment, Unguentum Tetrapharmacum; Br. Unguentum Resinæ; Fr. Cérat (onguent) de Résine anglais; Ger. Königssalbe, Harzsalbe, Zugsalbe.)

Manufacture: 35 p. c. Heat until liquefied rosin 35 Gm., add yellow wax 15 Gm., lard 50 Gm., strain, allow to congeal, occasionally stirring; in cold weather may use yellow wax 12, lard 53.

Prep.: 1. *Linimentum Terebinthinæ,* 65 p. c., see above.

2. *Emplastrum Resinæ.* Rosin Plaster. (Syn., Emp. Res., Rosin Adhesive Plaster, Adhesive Plaster; Fr. Emplâtre résineux (adhésif); Ger. Emplastrum adhæsivum, Heftpflaster.)

Manufacture: 14 p. c. Melt together, with gentle heat, lead plaster 80 Gm., yellow wax 6 Gm., add rosin 14 Gm., when melted mix thoroughly, strain, cool, stir until stiff.

3. *Ceratum Cantharidis,* 17.5 p. c.

Properties. I. Oil of Turpentine.—Internally—stimulant, carminative, cathartic, anthelmintic, hæmostatic, expectorant, diuretic, diaphoretic, antipyretic. Externally—rubefacient, irritant, counterirritant, antiseptic, disinfectant; contracts vessels, increases peristalsis, gastric secretion, stimulates heart, depresses nervous system. Large doses produce gastro-enteritis, vomiting, diarrhœa, suppressed urine, lumbar pains, urethral burning, hæmaturia, strangury, insensibility, death by paralyzed respiration. It is excreted by the skin, bronchi, and kidneys; inhaling vapors give nasal, ocular, and renal irritation.

II. Terpin Hydrate.—Antiseptic (arresting the development of tubercle bacilli), expectorant, diuretic, diaphoretic.

III. Terebene.—Stimulant, disinfectant, expectorant, astringent.

IV. Resin.—Antiseptic, slight stimulant.

USES.—I. OIL OF TURPENTINE: Internally—chronic bronchial catarrh, cystitis, gonorrhœa, leucorrhœa, gleet, chronic urinary troubles, piles, hemorrhages, puerperal fever, inflammation of bowels, traumatic erysipelas, intestinal worms, pneumonia, phosphorus-poisoning (old oil). Externally—rheumatism, sciatica, lumbago, neuralgia, bronchitis, pleurisy, peritonitis, tympanites, renal colic, gangrene, sprains, wounds, scabies, ringworms, enlarged glands, burns, frost-bites, colic; vapors of oil in whooping-cough, diphtheria, laryngitis. Often associated with various liniments, chloroform, camphor, olive oil, narcotic extracts, etc. The oleoresin may be given in pill form, hardened with magnesium oxide, dose, gr. 15–60 (1–4 Gm.)

II. TERPIN HYDRATE.—Acute and chronic bronchitis, whooping-cough, chronic nephritis, chronic cystitis, gonorrhœa.

III. TEREBENE.—Chronic bronchitis by inhalation and on sugar.

IV. RESIN.—Indolent ulcers, sores, wounds, in plasters, ointments, as emulsifying agent, chronic enteritis.

Poisoning: Have giddiness, gastro-enteritis, strangury, bloody, scanty urine, with violet odor; may have purging, cyanosis, dilated pupils, stertorous breathing, feeble, rapid pulse, coma, collapse. Give emetics, if no purging use enema, then plenty of water and demulcent drinks, hot fomentations to loins, opium to allay pain.

Allied Products:

1. **Pix Liquida.** Tar, *official.*—(Syn., Pix Liq., Pine Tar, Resina Empyreumatica Liquida; Fr. Goudron végétal; Ger. Holztheer, Theer.) A product obtained by the destructive distillation of the wood of *Pinus palustris* or other species of *Pinus* (*P. Tæ'da, P. rig'ida, P. sylves'tris,* and *Larix sibir'ica.*)

Manufacture: Refuse pine wood, cut in billets, is stacked compactly and covered with earth, except an opening at the apex for ignition and the escape of gases; slow combustion without flame is allowed to proceed, while a ditch at the bottom serves to run off the tarry liquid that is ladled into barrels; the wood is converted into charcoal and thus becomes a valuable by-product. In Europe permanent clay furnaces are used over and over. It is a true, impure turpentine, semi-liquid, viscid, blackish-brown, non-crystalline, translucent in thin layers, granular and opaque with age; odor empyreumatic, terebinthinate, taste sharp, empyreumatic; miscible with alcohol, ether, chloroform, glacial acetic acid, fixed or volatile oils; heavier than water, slightly soluble in it—solution pale yellowish-brown, acid reaction. *Tests:* 1. Aqueous solution 10 Ml. (Cc.) with a drop of ferric chloride T. S.—greenish-brown color. Dose, gr. 5–30 (.3–2 Gm.), in pill.

CONSTITUENTS.—Acetic acid, small quantities of formic, propionic, capronic acids, acetone, methyl alcohol, mesit, toluol, xylol, cumol, methol (all passing over with the light oil of tar,) naphthalene, pyrene, chrysene, paraffin, phenols, creosote (25 p. c.), pyrocatechin, empyreumatic resin.

PREPARATIONS.—1. *Syrupus Picis Liquidæ,* Syrup of Tar. (Syn., Syr. Pic. Liq., Syrupus Piceus; Fr. Sirop de Goudron; Ger. Theersirup.)

Manufacture: ½ p. c. Dissolve tar .5 Gm. in alcohol 5 Ml. (Cc.), add magnesium carbonate 1 Gm., sugar 5 Gm., triturate thoroughly, add water 41 Ml. (Cc.), stir occasionally for 2 hours, filter, return filtrate until clear, in which dissolve sugar 80 Gm., strain, add through strainer, water q. s. 100 Ml. (Cc.). Dose, ʒj–4 (4–15 Ml. (Cc.)).

2. *Unguentum Picis Liquidæ.* Tar Ointment. (Syn., Ung. Pic. Liq.; Fr. Pomatum cum Pice, Pommade de Goudron; Ger. Theersalbe.)

Manufacture: 50 p. c. Melt yellow wax 15 Gm., add lard 35 Gm., and to melted mixture add tar 50 Gm., previously warmed, incorporate thoroughly, strain, stir until congealed.

3. *Oleum Picis Liquidæ Rectificatum.* Rectified Oil of Tar. (Syn., Ol. Pic. Liq. Rect., Rectified Tar Oil; Fr. Huile volatile de Goudron rectifiée; Ger. Gereinigtes Theeröl.)

Manufacture: Distil wood-tar and collect that fraction of the distillate lighter than water, redistil. This volatile oil is a thick liquid, dark reddish-brown color, strong, empyreumatic odor and taste; soluble in alcohol, solution being acid, sp. gr. 0.975; contains hydrocarbons, phenols of acetic acid and other acids, undetermined empyreumatic products present in tar, being largely oil of turpentine. Dose, ♏ij–5 (.13–.3 Ml. (Cc.)), in pills, water, or syrup.

Unoff. Preps.: Alkaline Solution, 25 p. c. *Glycerite,* 6.3 p. c. *Liquor Picis Alkalinus,* 25 p. c., + potassium hydroxide 12.5, water q. s. 100. *Mistura Olei Picis,* 3.5 p. c. *Petroxolin,* 25 p. c. *Compound Ointment,* 4 p. c.

PROPERTIES.—Tar similar to oil of turpentine, but milder, scarcely ever vesicates, stimulant, expectorant, counter-irritant, insecticide. Internally—disturbs digestion, large doses may cause vomiting, colic, pain, headache, dark urine similar to phenol.

USES.—Internally—bronchitis, phthisis, vesical catarrh, constipation. Externally—scabies, scaly eruptions, eczema, burns, boils, sores, ulcers, gangrene, fissured nipples, hemorrhoids; fumes destroy foul odors.

2. *European Turpentine* from *P. Pinas'ter, P. Laric'io, P. sylves'tris, P. rotunda'ta* and other allied species; similar to our once official oleoresin.

3. *Chian Turpentine, Terebinthinæ Chia* (*Pista'cia Terebin'thus*) from Island of Chio or Scio. It is a greenish-yellow liquid, hardens to transparent mass, odor fennel-like, terebinthinate, taste mildly bitter. Once used for uterine cancer, but now in disfavor. Dose, gr. 20 (1.3 Gm.).

4. *Pix Carbonis Præparata* (Br.).—Heat coal-tar at 50° C. (122° F.) for 1 hour (stirring); soluble in benzene, chloroform, partially in alcohol.

Allied Plants:

1. *Pinus Tæ'da, Loblolly, Old Field* or *Frankincense Pine.*—Delaware, Florida, thence Texas, Arkansas. Grows along with *P. palustris,* and like it is a large tree, 18–30 M. (60–100°) high, but leaves (15–25 Cm.; 6–10′ long) and cones (7.5–12.5 Cm.; 3–5′ long) are smaller. This yields not near so great a per cent. of oleoresin as official plant, but one quite as good, consequently it is utilized for this and other purposes.

2. *P. sylves'tris, Wild Pine, Scotch Fir.*—Europe. Tree 21–24 M. (70–80°) high, leaves and cones only 5–7.5 Cm. (2–3′) long; this

yields much of the common European turpentine; *P. Pinaster* (*P. marit'ima*), S. Europe, much used for obtaining turpentine, pitch, and tar; *P. Stro'bus, Pinus Alba;* the dried inner bark; syrup comp.; syrup comp. with morphine.

3. *Lar'ix Larix* (*L. europæ'a, Pinus Larix*), *Venice Turpentine* (*Terebinthina Laricis—Veneta*).—Obtained from heartwood by bore holes; yellowish-green, transparent, fluorescent, odor terebinthinate, balsamic, soluble in alcohol; petroxolin, 20 p. c.

4. *Pini'tes succin'ifer* (*Pi'cea succinif'era*), *Succinum* (*Amber*).—A fossil resin, official 1820–1860; Baltic Sea, Prussia, coal mines. There are 50 Pinaceæ species that yield this resin. Such trees have been submerged under seawater, and from time to time yield by natural exudation this oleoresin, which is found along shores under and above water in irregular-sized pieces, that of 13 pounds (6 Kg.) being, so far, the largest; it is rough, dull, hard, brittle, fracture conchoidal, glossy, transparent, yellowish-red, sp. gr. 1.09, aromatic when heated, tasteless, melts at 288° C. (550° F.), yielding succinic acid, if heated higher get water, volatile acids, empyreumatic oil; contains succinic acid, $C_4H_6O_4$, several resins. Used for preparing succinic acid and (empyreumatic) oil of amber, for fumigation, in the arts. *Oleum Succini*, official 1820–1860. *Oleum Succini Rectificatum,* official 1820–1890. Used as stimulant antispasmodic, diuretic for hysteria, whooping-cough, infantile convulsions, intestinal irritation, amenorrhœa. Externally—rheumatism, rubefacient liniments. Dose, ♏v–15 (.3–1 Ml. (Cc.)).

5. *Tsu'ga* (*Ab'ies*) *canaden'sis, Pix Canadensis* (*Canada Pitch, Hemlock Pitch*).—Prepared resinous exudation, official 1840–1890; N. America. Hemlock spruce is an evergreen tree 18–24 M. (60–80°) high, .6–1 M. (2–3°) thick, trunk straight, uniform size for 12–15 M. (40–50°), bark rough, leaves 18 Mm. ($\frac{3}{4}$′) long, 2 Mm. ($\frac{1}{12}$′) wide, in 2 rows, numerous, glaucous, silvery beneath, cones ovate, 2.5 Cm. (1′) long, resin (oleoresin) reddish-brown, translucent, or opaque, nearly hard, brittle, fracture shining, conchoidal; odor mild, balsamic, terebinthinate. Oleoresin is obtained by exudation, incision, or boxing; yield small. Used as stimulant, irritant, in plasters. *Emplastrum Picis Canadensis,* official 1860–1890.

PINUS PUMILIO. DWARF PINE.

Oleum Pini Pumilionis. Oil of Dwarf Pine Needles, *official.*

Pinus montana, *Miller.* } A volatile oil distilled from the fresh leaves.

Habitat. C. Europe: Tyrolese Alps, Carpathian Mountains, 1300–2500 M. (4200–8200°) elevation.

Syn. Dwarf Pine, Mountain Pine; Ol. Pin. Pumil., Dwarf Pine Oil, Pine Needle Oil; Ger. Latschenkieferöl, Krummholzöl.

Mon-ta'na. L. *montanus,* mountainous—*i. e.,* preferred place of growth.

Pu-mil'io. L. *pumilio, onis,* fr. *pumilus,* dwarfish, diminutive—*i. e.,* in reference to its small size.

Plant.—Small tree, branches decumbent or knee-like, more or less erect; bark persistent, dark colored; leaves 2 in a sheath, 2–5 Cm. ($\frac{4}{5}$–2′) long, straight, scythe-shaped, obtuse apex, dull green, slightly glaucous; fruit (cones) ovoid, 4 Cm. ($1\frac{3}{5}'$) long, pyramidal protuberance on each scale on exposed side (outer).

Constituents.—Volatile oil, resin, tannin, bitter extractive.

Oleum Pini Pumilionis. Oil of Dwarf Pine Needles. This volatile oil, distilled from the fresh leaves (needles), is a colorless, faintly yellowish liquid, pleasant, aromatic odor, bitter, pungent taste, sp. gr. 0.860, no portion distils below 170° C. (338° F.), lævorotatory; contains *l*–pinene, *l*–phellandrene, sylvestrene, bornyl acetate (to which odor is due), cadinene. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 Ml. (Cc.)), on sugar, capsules, pastilles.

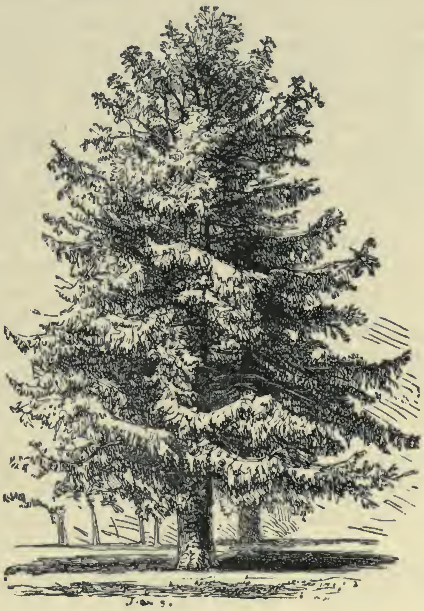


Fig. 17.—*Abies Abies (excelsa).*

Properties and Uses.—Antirheumatic, expectorant, stimulant, antiseptic; chronic rheumatism (internally), chronic bronchitis, laryngitis (inhaled); may rub on rheumatic joints, and cover with cotton; inhalant or vapor (oil 10 Ml. (Cc.), + magnesium carbonate 5 Gm. + distilled water q. s. 100 Ml. (Cc.); of this add ʒj (4 Ml. (Cc.)) to hot water ℥xx (600 Ml. (Cc.)) and inhale through it; allays irritation and diminishes bronchial secretion, catarrhal inflammation. A juice (Hungarian balsam) exudes spontaneously from the tips of young branches, to which flasks are attached for easy collection, and this possesses properties of turpentine as well as of the oil.

Allied Plants:

1. *Abies Abies* (*excel'sa*), *Pix Burgundica, Burgundy Pitch.*—The prepared resinous exudation, official 1820–1900; S. Europe (Bur-

gundy province, France). Lofty tree, 24–45 M. (80–150°) high; leaves short, 4-cornered, green; flowers, staminate and pistillate; fruit purple, cylindrical; scales oval. The oleoresin (Jura turpentine) is obtained from incisions made through the bark, after which it is melted in water and strained, thus yielding the once official product. It is yellowish-brown, hard, yet gradually conforming to the container, shining, conchoidal fracture, opaque or translucent, brittle, softened by heat, aromatic, terebinthinate, sweetish, not bitter; contains volatile oil 5 p. c., water 5–10 p. c. (absorbed during treatment), remainder is resin (chiefly abietic acid). Stimulant, counter-irritant, in plasters as a base and for support; rheumatism, joint affections, chest troubles, pleurisy, bronchitis, catarrh, asthma, hepatitis, phthisis, pneumonia.

2. *A. balsam'ea, Terebinthina Canadensis, Canada Turpentine.*—The liquid oleoresin (balsam of fir), official 1820–1910; Canada, United States, chiefly Laurentine Mountains, Quebec. Beautiful, ornamental tree (American Silver Fir), 9–15 M. (30–50°) high, pyramidal shape; bark smooth, reddish-gray when young, filled with blisters (reservoirs) containing the oleoresin; leaves 2 Cm. ($\frac{4}{5}$′) long, linear, silvery beneath; flowers, staminate—catkins, pistillate—cones, 5–10 Cm. 2–4′ long, 2.5 Cm. (1′) broad; pollen bright yellow; seeds with wing. Oleoresin (Canada turpentine), viscid, yellowish, transparent, odor agreeable; taste terebinthinate, bitter, acrid, soluble in ether, chloroform, benzene; collected by puncturing vesicles with the sharp-pointed nozzle of the "balsam-collector's" can; contains volatile oil 24 p. c., acid resin 63 p. c., indifferent resin 12 p. c., acids (4)—canadinic, canadolic, *a*- and *b*-canadinolic. Properties and uses, similar to oil of turpentine, except this dries into an adhesive, transparent varnish, thus becoming valuable in microscopic technique. Dose, gr. 15–60 (1–4 Gm.). *A. Fra'seri.*—Resembles the preceding, but cones only 5 Cm. (2′) long, sharp-pointed scales projecting and recurved; New England, North Carolina, in mountains; used for collecting balsam of fir.

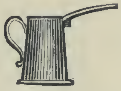


FIG. 18. — Can for collecting balsam of fir.

3. *A. Pi'cea (pectina'ta), Strassburg Turpentine (Terebinthina Argentoratensis).*—Vosges. Obtained like Canada balsam, chiefly differing in odor (lemon); taste bitter, not acrid; completely soluble in absolute alcohol. *A. Menzie'sii, Oregon Balsam of Fir,* resembles Canada balsam when fresh, but becomes gradually granular and opaque.

4. *Thu'ja occidenta'lis, Arbor Vitæ (White Cedar).*—The fresh tops, official 1880–1890; Canada, United States. Tree resembles closely *Chamæcyp'aris sphæroi'dea (Cupres'sus thyoi'des)*, 6–15 M. (20–50°) high, trunk crooked, bark pale, shreddy, wood light, soft, durable; leaves 4 rows, rhomboid-ovate, pointed, roundish gland on the back, balsamic, terebinthinate odor; pungent, camphoraceous, bitter taste; twigs flattish; contains volatile oil 1 p. c., resin, tannin, pinipicrin, thujin, thujigenin. Used as stimulant, diuretic, irritant for intermittents, coughs, fevers, scurvy, rheumatism, amenorrhœa, dropsy, worms,

pulmonary catarrh, ulcers, warts; in infusion, decoction, fluidextract (alcohol). Dose, gr. 15–60 (1–4 Gm.).

5. *Ag′athis loranthifo′lia* (*Dam′mara*), *Dammar.*—E. India. A spontaneous resinous exudation, in transparent, straw-colored rounded masses, almost odorless, and tasteless, fracture conchoidal; contains resin of which 40 p. c. is insoluble in alcohol and 60 p. c. soluble; by distillation get terpene, $C_{10}H_{16}$. Used mostly in varnishes, rarely in plasters. That from New Zealand—*Kauri Resin*—is found also fossil and often sold as copal.

6. *Cal′litris quadrival′vis, Sandaraca* (*Sandarac*).—N. W. Africa. It is a resin which exudes spontaneously or from incisions made through the bark; occurs in elongated pale yellow tears 5–15 Mm. ($\frac{1}{5}$–$\frac{3}{5}$′) long, covered with whitish dust, of a glass-like lustre, transparent, hard, brittle; odor and taste terebinthinate, balsamic, bitter, soluble in hot alcohol, ether; it resembles peas in size, often mixed with mastic, owing to its cheapness, but distinguished by being pulverulent when chewed (and not adhesive as with mastic); contains 3 resins, differing in solubility, also bitter principle; according to Tschirch—sanduracolic acid 85 p. c., callitrolic acid 10 p. c., volatile oil (amount depending upon freshness); mild stimulant; mainly used in varnishes.

JUNIPERUS. JUNIPER.

Oleum Juniperi. Oil of Juniper, *official.*

Juniperus communis, *Linné.* } A volatile oil distilled from the ripe fruit.

Habitat. N. America (Canada, N. United States), Asia, Europe, N. Africa; dry woods, hills.

Syn. Juniper Bush, Juniper Berries, Fructus (Baccæ) Juniperi; Fr. Genièvre, Baies de Genièvre; Ger. (Gemeiner) Wachholderbeeren, Ol. Junip., Juniper Oil, Oil of Juniper Berries, Oleum Fructus (Baccæ) Juniperi; Fr. Essence de Genièvre; Ger. Wachholder(beer)öl.

Ju-nip′e-rus. L. fr. Celtic *juniperus*, rough—*i. e.*, its foliage; or fr. L. *juvenis*, young, + *parere*, to produce—*i. e.*, young fruit, leaves, etc., are continually replacing the old.

Com-mu′nis. L. common, general—*i. e.*, the usual or ordinary kind.

Plant.—Evergreen shrub 2–5 M. (6–15°) high, with many close branches, some often prostrate; leaves narrow, longer than fruit, 12 Mm. (½′) long, in whorls of 3's, sharp-pointed, channeled, deep green; flowers diœcious—staminate catkins, pistillate cones; fruit (galbulus) roundish berry, 8 Mm. (⅓′) broad, dark purplish with bluish-gray bloom, 3-rayed, pulpy, 3-seeded, oil-glands on surface, ripens second year; odor and taste terebinthinate.

Constituents.—Volatile oil .5–2.5 p. c., sugar 15–30 p. c., resin 10 p. c., juniperin, proteids 4 p. c., fat, wax, malates, formic and acetic acids.

Oleum Juniperi. Oil of Juniper.—Obtained from the ripe fruit by distillation with salt and water, or steam; it is a colorless, faintly green or yellow liquid, characteristic odor and taste of juniper fruit, soluble in 4 vols. of alcohol with not more than slight cloudiness, sp. gr. 0.870, lævorotatory; contains chiefly pinene, $C_{10}H_{16}$, with some cadinene, $C_{15}H_{24}$, juniper camphor, and an ester to which odor and taste are due. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏v–15 (.3–1 Ml. (Cc.)).

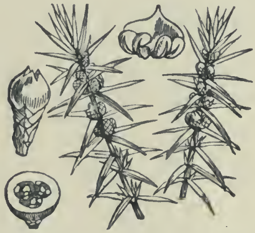


FIG. 19.—*Juniperus communis.*

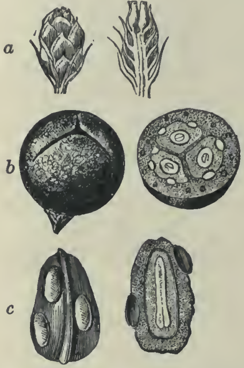


FIG. 20.—Juniperus: *a*, fertile catkin and longitudinal section; *b*, galbulus and transverse section; *c*, seed and longitudinal section magnified.

PREPARATIONS.—1. *Spiritus Juniperi.* Spirit of Juniper. (Syn., Sp. Junip.; Fr. Alcoolat (Esprit) de Genièvre; Ger. Wachholderspiritus.)

Manufacture: 5 p. c. Dissolve oil 5 Ml. (Cc.) in alcohol q. s. 100 Ml. (Cc.). Dose, ʒj–4 (4–15 Ml. (Cc.)).

2. *Spiritus Juniperi Compositus.* Compound Spirit of Juniper. (Syn., Sp. Junip. Co.; Fr. Alcoolat de Genièvre composé; Ger. Zusammengesetzter Wachholderspiritus.)

Manufacture: ⅖ p. c. Dissolve oil of juniper .4 Ml. (Cc.), oil of caraway .05 Ml. (Cc.), oil of fennel .05 Ml. (Cc.), alcohol 70 Ml. (Cc.), gradually add water q. s. 100 Ml. (Cc.). Dose, ʒj–4 (4–15 Ml. (Cc.)).

Unoff. Preps. FRUIT: *Extract*, dose, gr. 10–30 (.6–2 Gm.). *Fluidextract* (dil. alc.), dose, ʒj–2 (4–8 Ml. (Cc.)). *Infusion*, 5 p. c., dose, ℥ss–2 (15–60 Ml. (Cc.)). *Succus Juniperi inspissatus* (Ger.), 20 p. c.

PROPERTIES.—Similar to turpentine; stimulant, diuretic, anodyne, emmenagogue, carminative, stomachic, antiseptic.

USES.—Renal dropsy, vesical catarrh, rheumatic pains, swellings.

JUNIPERUS OXYCEDRUS. PRICKLY CEDAR.

Oleum Cadinum. Oil of Cade, *official*.

Juniperus Oxycedrus, *Linné.* { An empyreumatic oil distilled (dry) from the wood.

Habitat. S. Europe, Spain.

Syn. Prickly (Spanish, Berry-bearing) Cedar, Large Brown-fruited Juniper; Ol. Cadin., Cade Oil, Oil of Juniper Tar, Oleum Juniperi Empyreumaticum (Nigrum); Fr. Huile de Cade; Ger. Kadeöl, Takinöl, Spanisch-Cederöl.

Ox-y-ce'drus. L. fr. Gr. ὀξύς, sharp, pointed, + κέδρος, cedar—*i. e.*, cedar with pointed leaves.

Ca-di'num. L. fr. Fr. *cade*, juniper; Bohem. *kadik*, juniper—*i. e.*, European cedar.

PLANT.—Shrub 2.4–3.7 M. (8–12°) high, resembling *J. commu'nis,* branches spreading, drooping; leaves medium size, awl-shaped, pointed, 2 furrows on upper edge; fruit 12 Mm. (½′) thick, reddish, shining, 2 white lines on apex.

CONSTITUENTS.—Volatile oil, resin, tannin, extractive (acetic acid, pyroligneous acid, acetone, methyl alcohol, etc.).

Oleum Cadinum. Oil of Cade.—Should be dry (downward) distilled from the heartwood, similar to obtaining tar, pieces of wood being laid carefully upon one another and covered with earth except an opening at the top, thus permitting slow combustion; inverted iron pots also are filled with billets, surrounded with worthless wood and set on fire, producing sufficient heat for distillation; product is caught in receptacles, set aside 15–20 days for separation of tarry and aqueous layers, the upper oily one constituting the commercial product. It is a dark brown, clear, thick liquid, tarry, empyreumatic odor, warm, faintly aromatic, bitter taste, almost insoluble in water, imparting to it acid reaction, partially soluble in alcohol, petroleum benzin, completely soluble in ether (3), amyl alcohol, chloroform, glacial acetic acid, oil of turpentine, sp. gr. 0.980–1.055; contains phenols and sesquiterpene—cadinene, $C_{15}H_{24}$. *Test:* 1. Shake 1 part with warm distilled water (20); filtrate + few drops of ferric chloride solution (1 in 1000)—red; reduces silver ammonium nitrate T. S. (cold), and alkaline cupric tartrate T. S. (hot). *Impurities:* Rosin, rosin oil. The oil from wood of *J. communis* often substituted. Dose, ♏iij–5 (.2–.3 Ml. (Cc.)).

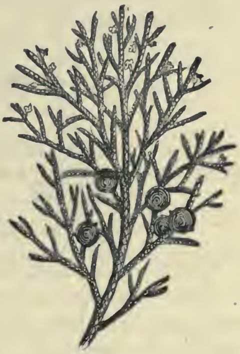


FIG. 21.—*Juniperus Sabina.*

PREPARATION.—(Unoff.): *Petroxolinum Cadini,* 25 p. c., *Unguentum Sulphuris Compositum,* 15 p. c.

PROPERTIES.—Anthelmintic, externally parasiticide.

USES.—Psoriasis, pityriasis rubra, chronic eczema, prurigo, psora, favus. This oil may replace the official *Oleum Picis Liquidæ,* both having about the same effect.

Allied Plants:

1. *Juniperus Sabi'na, Savin, Shrubby Red Cedar.*—The tops, official 1820–1910; Europe, Siberia, N. America, rocky banks, mountains. Evergreen shrub, procumbent or erect, 1–4.5 M. (3–15°) high, branched, bark greenish (young), brownish (old); flowers diœcious; fruit galbulus, bluish, size of a pea, 1–3-seeded. Tops yellowish-green, subquadrangular branchlets; leaves 4 rows, dark green, scale-like, ovate-lanceolate, acute, imbricated, shallow groove on back, roundish gland in middle; odor peculiar, terebinthinate; taste disagreeable, resinous, bitter; solvents: boiling water, alcohol; contains volatile oil 2–5–10 p. c., resin, tannin, salts (K, Ca). Diuretic, emmenagogue, ecbolic, irritant, hæmagogue; amenorrhœa, dysmenorrhœa, menorrhagia, rheumatism, gout; warts, ulcers, dental caries, tinea capitis, polypi.

Poisoning: Abdominal pain, vomiting, strangury, convulsions, coma—magnesium sulphate (full dose), demulcents, anodynes, stimulants. Dose, gr. 5–15 (.3–1 Gm.), in syrup, honey; fluidextract (alcohol), ♏v–15 (.3–1 Ml. (Cc.)); cerate (25 p. c.), to prolong secretion from blisters, etc.; infusion, tincture.

2. *J. virginia'na, Red Cedar.*—The tops, official 1820–1880; United States. Slow-growing evergreen, 6–24 M. (20–80°) high, 15–45 Cm. (6–18′) thick, branches spreading, horizontal near the ground; leaves small, glandular, ternate in pairs; odor of tops peculiar; taste pungent; contains volatile oil, resin, tannin; wood yields volatile oil (of red cedar) containing cedrene, $C_{15}H_{24}$, and cedrene camphor, $C_{15}H_{26}O$. Differs from *J. Sabina* in habit, smaller erect fruit, more acute leaves, reddish durable heartwood, yellowish sapwood, and weaker properties, but the tops and volatile oils may be substituted for each other. Branchlets bear excrescences (cedar apples), which are used as anthelmintic, dose, gr. 10–30 (.6–2 Gm.), ter die.

CLASS 6. **ANGIOSPERMÆ (Seeds clothed, enclosed in an ovary).**

SUB-CLASS 1. **MONOCOTYLEDONES (Embryo with one cotyledon, stem endogenous, leaves parallel-veined).**

6. GRAMINACEÆ. Grass Family.

Gram-i-na'se-e. L. fem. pl. of *gramin-eus* + aceæ, of or pertaining to grass—*gramen*, grass. Herbs, shrubs, or arborescent plants, largest endogenous order except Orchidaceæ. Distinguished by having leaves 2-ranked with split sheaths and ligule; stems (culms) hollow, closed at joints; flowers glumaceous, paleæ (chaff, husk) 2, stamens 3, hypogynous; anthers versatile; ovary superior, ovule 1; fruit caryopsis, stigmas feathery, hairy; universal; purgative, poisonous, cereals, fodder, sugar, volatile oil.

Genera: **1. Zea. 2. Saccharum. 3. Beta. 4. Agropyron. 5. Hordeum.**

AMYLUM. STARCH.

Zea Mays, *Linné.* } The starch separated from the grain.

Habitat. S. America; cultivated in warm temperate zones.

Syn. Corn, Indian (Turkish) Corn, Maize, Mealies, Guinea (Turkey) Wheat; Amyl., Corn Starch; Fr. Maïs, Fécule (Amidon) de Maize; Ger. Mais, Amylum Tritici, Weizenstärke, Stärke, Kraftmehl, Maisstärke.

Ze'a. L. fr. Gr. *ζάω*, to live—*i. e.*, from its life-supporting properties to beast and man.

Ma'ys. L. *maydis*, Sp. *maiz*, fr. *mahiz*, its native name in the Haitian Island language, its native habitat.

Am'y-lum. L. starch, Gr. *ἄμυλον* = *a*, not, + *μύλη*, a mill—*i. e.*, so fine as not requiring to be ground in a mill.

Starch, fr. *stark*, strong, stiff, so called from its use in stiffening various substances.

PLANT.—An annual; stem 1.2–4.5 M. (4–15°) high, erect, stiff, unbranched, grooved on one side, smooth, solid, with spongy centre, jointed; roots fibrous; leaves many, linear, .6–1 M. (2–3°) long, 5–7.5 Cm. (2–3′) wide, channeled; flowers monœcious—staminate spikelets numerous, in pairs, forming a long-stalked terminal panicle (tassel), —pistillate thick spikes, from the husks of which project long, slender styles and stigmas (silk); fruit, caryopsis (kernel) and rachis (cob) form the spike (ear), which is enclosed by the bracts of the spathe (husks). Kernels (seed, grain) occur in 8–10–12 rows, or some even number—yellow, white, red, purple; styles and stigmas (once official under the name of *Zea*—fluidextract (dil. alc.)), a matted mass of slender filaments, thread-like, 5–15 Cm. (2–6′) long, .5 Mm. ($\frac{1}{50}$′) thick, yellowish, brownish. STARCH, in fine powder, irregular, angular, white masses, consisting chiefly of polygonal, rounded, spheroidal starch grains, .003–.035 Mm. ($\frac{1}{8325}$–$\frac{1}{5000}$′) broad, usually with lenticular, 3–4-rayed central cleft (rounded—circular marking); insoluble in cold water, alcohol inodorous; taste slight, characteristic. *Tests:* 1. With iodine T. S.—deep blue. 2. Boil 1 Gm. with water (15), cool—translucent, whitish jelly. 3. Incinerate .5 Gm.—ash .5 p. c.; aqueous mixture neutral. 4. With diluted acids or diastase—dextrin, $C_{12}H_{20}O_{10}$, dextrose, $C_6H_{12}O_6$, water, H_2O, which reveals the starch formula to be $(C_6H_{10}O_5)_3$. *Solvents:* water, glycerin—boiling. Dose, ʒss–2 (2–8 Gm.).

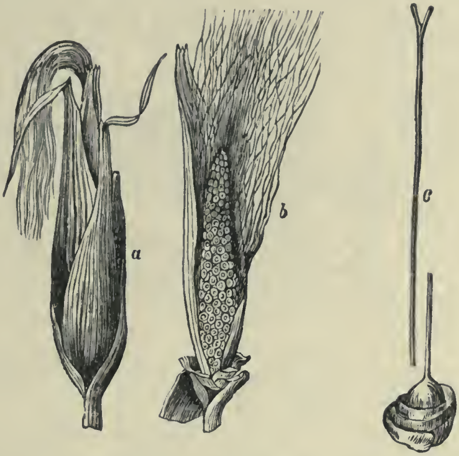


FIG. 22.—*Zea Mays:* *a*, spadiceous flower with styles protruding; *b*, the same freed from cover leaves reduced in size; *c*, a single style with stigma.

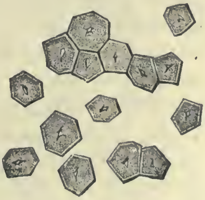


FIG. 23.—Corn starch.

ADULTERATIONS.—Allied starches, especially of wheat, potatoes (white and sweet), yam, etc., all recognized by the microscope in the shape of the granules.

Commercial.—Starch is prepared from the grain by soaking in hot water, to which an alkali sometimes is added, until the testæ are softened, then grinding under water and washing it upon large sieves with water; by this means the starch is suspended in the water and will deposit upon being allowed to remain undisturbed for some hours; the gluten when present remains in the supernatant alkaline water or upon the sieve. When all the starch is deposited on the bottom of the container (tank), the liquid is racked off, the starch cut into blocks and carefully dried in suitable chambers. The finely ground corn meal may also be kneaded under a stream of running water until milkiness ceases, then allowing the milky water to subside.

Constituents.—$C_6H_{10}O_5$, or a multiple of this, ash 1 p. c.

Preparations.—1. *Glyceritum Amyli.* Glycerite of Starch. (Syn., Glycer. Amyl., Plasma, Glycamyl; Br. Glycerinum Amyli, Glycerin of Starch; Fr. Glycéré d'Amidon, Glycérat simple (d'Amidon); Ger. Unguentum Glycerini, Glycerinsalbe.)

Manufacture: 10 p. c. Triturate, until homogeneous, starch 10 Gm. with water 10 Ml. (Cc.), add this gradually to hot glycerin 80 Gm., continue heat, constantly stirring, at 140° C. (284° F.) until translucent jelly is formed.

2. *Extracts of Aconite, Belladonna, Cascara Sagrada*, etc., as a diluent.

Unoff. Preps.: Iodized Starch (*Amylum Iodatum*), 95 p. c., + iodine 5, + little distilled water—bluish-black powder, dose, ʒj–4 (5–15 Gm.). *Paste, Poultice, Water.*

Properties.—Nutritive, demulcent, protective, absorbent.

Uses.—Mostly externally as a dusting-powder to allay itching and burning of the skin in erythema, urticaria, erysipelas, small-pox, to saturate bandages for fractures, as an injection for inflamed rectum or bladder, as a vehicle for enemata, to harden pills, antidote to iodine-poisoning. Owing to starchy foods fermenting they should be avoided in fermentative dyspepsia.

Allied Starches:

While the official starch is a product from corn, hence called corn starch, it should be borne in mind that there are many plants that also yield starch, but each kind peculiar to itself. This should not be accepted to infer total physical and chemical difference, because these in the main are uniform. It is only in the shape of the starch granules as viewed under a microscope that we recognize a varying form, and that this is characteristic alone for the source whence derived. Thus, when given a starch or mixture of starches, a small portion moistened with water and viewed under high power readily reveals its origin by the various outline granules. In this way (from their contained starch) it is possible to distinguish many official roots, rhizomes, seeds, fruits, etc., as it is also the cereals, edible fruits, and vegetables.

I. *Wheat Starch* (*Agropy'ron* (*Trit'icum*) *æsti'vum*). U. S. P. 1880. Lenticular, large and small granules, layers indistinct, hilum slight, near the centre.

II. *Potato Starch* (*Sola'num tubero'sum*). Ovate, granules unusually large, layers very distinct, hilum rather small and at the narrow end.

GRAMINACEÆ

III. *Maranta Starch* (*Maran'ta arundina'cea*). Ovate granules layers delicate, distinct, hilum at the broad end, often cleft.

IV. *Corn Starch* (*Ze'a Ma'ys*). Polyhedric granules, layers not easily distinguishable, hilum central, large.

V. *Oat Starch* (*Ave'na sati'va*). Polyhedric granules often united in ovoid masses (compound), layers and hilum indistinct.

VI. *Rice Starch* (*Ory'za sati'va*). Polyhedric granules, uniform, similar but much smaller than corn starch, hilum very small.

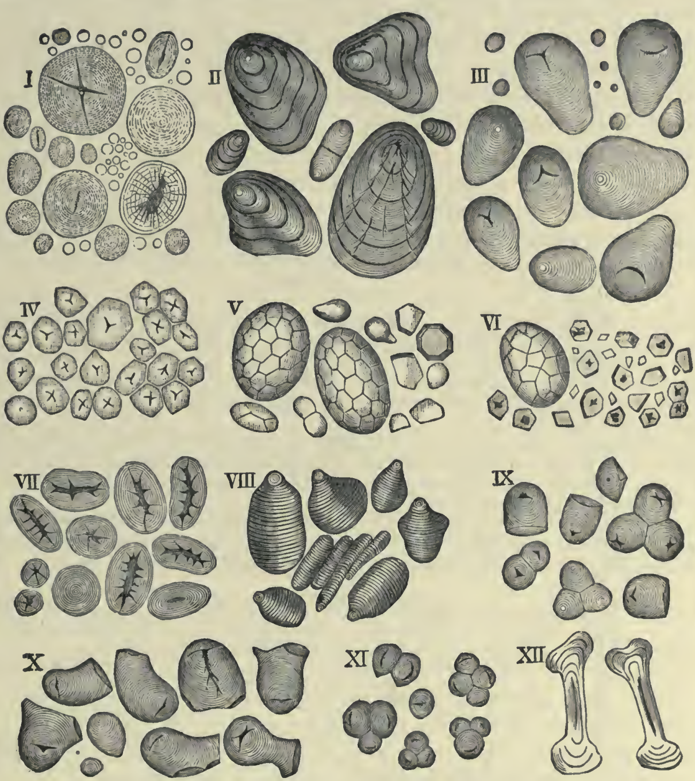


Fig. 24.—Starch granules, magnified 475 diameters.

VII. *Bean Starch* (*Phase'olus vulga'ris*). Ellipsoidal granules, layers distinct, crossed by fissures radiating from centre.

VIII. *Curcuma Starch* (*Cur'cuma lon'ga*, +). Elliptic granules, flat, contracted at one end; layers numerous, delicate, hilum small, at narrow end.

IX. *Tapioca*. *Brazilian Arrow-root* [*Man'ihot Manihot* (*utilis'sima*)]. *Cassava Starch*. Muller-shaped, layers indistinct, hilum near rounded end, often cleft.

X. *Sago*. *Pearl Sago* (*Metrox'ylon Rum'phii* and *M. Sa'gu*). Ovate granules, 1 end truncate, layers more or less distinct, hilum at rounded end, often cleft.

XI. *Sarsaparilla Starch* (*Smi'lax officina'lis*). Roundish, compound, usually with cleft hilum.

XII. *Euphorbia Starch* (*Euphorbiaceæ Plantæ*). Elongated, bone-shaped nodular ends, layers distinct.

Derivative Product:

1. *Dextrinum, Dextrin*, $C_6H_{10}O_5$. Obtained by heating starch 204° C. (400° F.), in a cylinder or flat vessel; this yellowish product is often called in commerce *British Gum;* may also make it by heating starch 110° C. (230° F.), with diluted nitric acid. It is a pale yellow, amorphous, gummy mass, soluble in water, insoluble in alcohol or ether; dextrinum album—mixture of soluble carbohydrates, amylo-, achroo-, erythro-, malto-dextrin, unconverted starch; pasta dextrinata, 33 p. c., + glycerin 33, water 34.

SACCHARUM. SUGAR.

Saccharum officinarum, *Linné,*
Beta vulgaris, *Linné,* var. **Rapa.**

Sucrose, $C_{12}H_{22}O_{11}$, obtained from cultivated varieties, and other sources.

Habitat. S. Asia, cultivated in tropics and subtropics, Africa, E. and W. Indies, Cuba, Brazil, S. United States, especially Louisiana. The sugar beet in France, Germany; cultivated in Kansas, California, Nebraska, Utah.

Syn. Sacch., Sucrose, Cane-sugar; Br. Saccharum Purificatum, Refined Sugar (Sucrose); Fr. Sucre Blanc officinal, Sucre de Canne, Sucre; Ger. Zucker, Rohrzucker, Weisserzucker.

Sac'cha-rum. L. sugar, Gr. *σάκχαρον*, fr. Ar. *sukkar*, Hung. *zukur*, ML. *succarum* after *succus*, a juice, fr. Skt. *carkara*, candied sugar, orig. grit, gravel.

Of-fi-ci-na'rum. L. *officina*, workshop—*i. e., opus*, work, + *facere*, to do, = of or belonging to the shop or store.

Be'ta. L. the beet, fr. Celtic *bett*, red—*i. e.*, the red color of the roots.

Vul-ga'ris. L. ordinary, common—*i. e.*, the kind most universally found wild.

Ra'pa. L. *rapa*, fr. *rapum*, turnip—*i. e.*, the resemblance of the roots.

Plants.—*Saccharum officinarum, Sugar Cane*, perennial herb; rhizome thick, jointed, solid; roots fibrous; stems many, 2–4.5 M. (6–15°) high, 2.5–5 Cm. (1–2′) thick, jointed, solid, containing white juicy pith, and, according to variety, outside yellow, greenish-yellow, purple, or striped, joints 7.5 Cm. (3′) apart, giving rise to encircling leaves; leaves 1–1.2 M. (3–4°) long, 5 Cm. (2′) wide, flat, acuminate, white, midrib, longitudinally striate, dentate; flowers pinkish, in large terminal panicles; *Beta vulgaris*, var. *Rapa, Common, Sugar Beet*—Chenopodiaceæ; herb with biennial fleshy root, 30–37.5 Cm. (12–15′) long, 7.5–10 Cm. (3–4′) thick, conical, deep purple or yellow; stem .6–1.2 M. (2–4°) high, paniculately branched; leaves—radical 15–30 Cm. (6–12′) long, petioles 10–20 Cm. (4–8′) long—cauline smaller as nearing apex; flowers July–Aug., axillary clusters. Sugar, in white, hard, dry crystals, white, crystalline powder, odorless, sweet taste, permanent, soluble in water (.5), boiling water (.2), alcohol (170), insoluble in chloroform, ether; saturated aqueous solution (syrup) neutral, dextrorotatory, sp. gr. 1.340; by ferments in air or by boiling with diluted acids syrup is converted into invert sugar (dextrose + levulose) which then is directly fermentable and reduces red cuprous oxide from alkaline solution of cupric oxide; kept for a time at 180° C. (356° F.) becomes converted into levulosane, $C_6H_{10}O_5$, and dextrose (glucose), $C_6H_{12}O_6$, without loss of weight. *Tests:* 1. Saturated solution in large, well-closed, completely filled bottle—deposits no sediment on prolonged standing (abs. of insoluble salts, ultramarine, Prussian blue). 2. Aqueous solution (2 in 1) viewed horizontally through vertical cylinder of 25 Mm. (1′) diameter—colorless; incinerate 2 Gm.—ash .05 p. c.

Adulterations.—Inferior sugars whitened with ultramarine or Prussian blue, insoluble salts, calcium, chloride, sulphate.

Commercial.—Plants of the sugar cane (there being several varieties) all resemble more or less our Indian corn, produce shoots readily, and are cultivated by cuttings planted in rows, while those of the sugar beet are practically acaulescent, biennial, and grown directly by planting the seeds annually under careful tillage, in rich soil. Cane-sugar was used by the ancients only as a medicine, being brought first from India to Europe by the Venitians during the Crusades; with the discovery of Cape of Good Hope and sea route to E. Indies the Portuguese secured its commercial control, after which cultivation extended to Arabia, Egypt, Sicily, Spain, Canaries, America, W. Indies (1494). It is obtained by cutting off ripe cane stems near the ground, or pulling up and washing beet roots deprived of leaves, and passing them (stems, roots) through iron rollers, thereby expressing the grayish, turbid, sweet juice, which is run into shallow copper pans and boiled with lime (1 in 800) to neutralize free acid and to clarify (by coagulating albumen and gluten—removed by occasional skimming), and, when sufficiently concentrated, tenacious and granular, transferring to coolers, where it is stirred frequently, thence to casks with perforated bottoms, where it is drained 24 hours and then strongly agitated with wooden stirrers, causing granulation in 6 hours, thus yielding yellowish *raw, open pan, muscovado sugar,* which is packed into hogsheads and exported, the drainings being known as treacle or molasses. It is refined by dissolving in water with steam, heating with bullock's blood, skimming, filtering through canvas bags, percolating through large cylinders of animal charcoal, evaporating the colorless percolate in steam vacuum pans (to reduce pressure and heat) at 77° C. (170° F.), and, when sufficiently concentrated, running off the product into conical molds (centrifugals) having orifices closed, from which, after solidification, stoppers are removed for draining

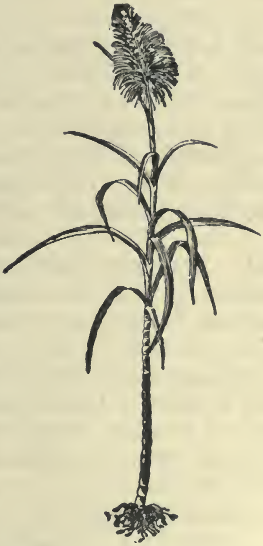


Fig. 25.—*Saccharum officinarum.*

(treacle), loaves sugared by pouring over them saturated syrup, which by slow infiltration passes through carrying with it all coloring matter and impurities, without dissolving any crystallized sugar, thus yielding whitish *refined, vacuum pan, loaf sugar.* Sugar may also be obtained from maple, birch, palm, etc.

Constituents.—Sugar cane: Juice 80 p. c., which contains sugar 16–21 p. c., water 78–84 p. c., mucilage, resin, fat, albumin .3–.4 p. c. Beets: Juice contains sugar 9–19 p. c., but yields only about 9 p. c., being more difficult to obtain, owing to excessive quantity of proteids, etc.

Preparations.—1. *Syrupus.* Syrup. (Syn., Sirup, Simple Syrup, Syrupus (Simplex) Sacchari; Fr. Sirop (de Sucre) simple; Ger. Syrupus simplex, Weisser Sirup.)

Manufacture: Dissolve sugar 85 Gm., by cold percolation, or by heat, in distilled water 45 Ml. (Cc.), heat to boiling point, strain, add through strainer distilled water q. s. 100 Ml. (Cc.), mix thoroughly; should have sp. gr. 1.313, and contain 64.54 p. c., by weight, of sugar. Dose, *ad libitum.*

> Preps.: 1. *Compound or Medicated Syrups, Emulsions,* as well as an ingredient of other preparations. 2. *Liquor Magnesii Citratis,* 60 p. c.

2. *Emulsum Amygdalæ,* 3 p. c. 3. *Ferri Carbonas Saccharatus,* 70 p. c. 4. *Massa Ferri Carbonatis,* 25 p. c. 5. *Pilulæ Ferri Carbonatis,* $\frac{3}{5}$ gr. (.04 Gm.). 6. *Pilulæ Ferri Iodidi,* $\frac{3}{5}$ gr. (.04 Gm.). 7. *Pulvis Cretæ Compositus,* 50 p. c. 8. *Pulvis Glycyrrhizæ Compositus,* 50 p. c. 9. *Trochisci* (various kinds).

Properties.—Demulcent, lenitive, stimulant, laxative, aliment, condiment, externally in certain ulcerations.

Uses.—Chiefly as vehicle, corrigent, preservative, antiseptic, excipient. Syrups protect ingredients against putrefaction, not always against fermentation, prevent iron preparations from oxidation; in troches, powders and mixtures covers taste of nauseous medicines, rendering insoluble substances more miscible with water; in food nutrient to adipose tissue, and a respiratory fuel; diuretic on healthy kidneys, has no effect on the teeth, good in cough, hoarseness, hiccough, aphthæ, ulcers, wounds, corneal and eyelid granulation, chronic laryngitis, chronic ozæna (as snuff), ascarides (by injection), fumes destroy offensive effluvia.

Allied Products:

1. **Glucosum. Glucose,** $C_6H_{12}O_6$, or hydrated, $C_6H_{12}O_6.H_2O$, *official.* —(Syn., Glucos., Syrupy Glucose, Liquid Glucose, Grape-sugar, Dextrose, Starch-sugar, Saccharum Amylaceum (Uveum); Fr. Sirop Cristal, Glucose Masse; Ger. Stärke-, Trauben-, Kartoffel-zucker, Glukose, Glykose.)

Manufacture: From grapes, decomposition of glucosides, but chiefly by the incomplete hydrolysis of starch—boil starch (100), water (400), sulphuric acid (.5–1.25) until iodine gives no starch reaction, neutralize (free acid) with chalk, clarify and decolorize liquid with clay and animal charcoal, filter, concentrate in vacuum-pan, when much calcium phosphate separates, filter, concentrate for glucose (liquid) or grape-sugar (crystals). It is a colorless, slightly colored, thick, syrupy liquid; odorless or nearly so; sweet taste; soluble in water, sparingly in alcohol; aqueous solution neutral, slightly acid; contains chiefly dextrose (*d*-glucose), $C_6H_{12}O_6$, 34–43 p. c., and dextrins, 30–45 p. c., maltose 0–19 p. c., water 14–23 p. c. *Tests:* 1. Add few drops of aqueous solution (1 in 20) to 5 Ml. (Cc.) of hot alkaline cupric tartrate T. S.—copious red precipitate of cuprous oxide (dist. from cane-sugar). 2. Incinerate—ash 1 p. c. *Impurities:* Heavy metals, arsenic, cane-sugar, water, free acid, starch, sulphur dioxide. Dose, *ad libitum.*

PREPARATIONS.—1. *Pilular Extracts of Belladonna, Hyoscyamus, Stramonium.*

PROPERTIES AND USES.—Similar to cane-sugar, nearly equal to it as a food; diuretic, dropsy, etc. One-half as sweet as cane-sugar; acts as a strong reducing agent in alkaline solutions; calcium sulphite often added as a preservative which accounts for it decolorizing free iodine. Crystals whitish, yellowish, brownish, soluble in water (1); contains dextrose 64–99.5 p. c., dextrin 0–22 p. c. Syrupus Glucosi (Br.)—liquid glucose (25) and syrup (50).

2. *Fructose, Fruit-sugar* (*Levulose*) $C_6H_{12}O_6$.—This often accompanies grape-sugar in fruits, honey, etc., sometimes in plants with cane-sugar. It is usually a colorless uncrystallizable syrup, nearly as sweet as cane-sugar, lævorotatory, soluble in water. May be produced from inulin by diluted acids; with nascent hydrogen yields mannite, with nitric acid is oxidized into succinic, acetic, and oxalic acids.

3. *Inosite, Phaseo-mannite,* $C_6H_{12}O_6.2H_2O$.—Found in juices of some meats, green fruits (Leguminosæ), asparagus, etc.; it is very sweet, crystallizes from water, alcohol; does not ferment, but with nitric acid yields explosive compounds and oxalic acid.

4. *Syrupus Fuscus, Molasses* (*Melasses*), official 1860–1870. Have two kinds: 1, W. India; black, ropy, peculiar odor, sweet, empyreumatic taste; yields by fermenting and distilling commercial rum, and is the kind once official; 2, Sugar House (Golden Drips, Grocer's Syrup); same as preceding, only thicker, different flavor, often largely adulterated with glucose, sp. gr. 1.40, contains solid matter 75 p. c. Both kinds have uncrystallizable sugar with some cane-sugar which failed to crystallize out; also have gum, coloring matter. If these be boiled with a strong solution of potassium dichromate, get violent reaction, green liquid; but if adulterated with one-eighth starch-sugar molasses, the reaction is wanting, color not changed.

Derivative Products:

1. *Rock Candy, Saccharum Crystallizatum.*—Heat concentrated cane-sugar syrup, add spirit, and upon cooling, white, transparent, oblique, 4-sided prisms form; this is the purest kind of sugar.

2. *Barley-sugar, Saccharum Hordeatum.*—Cane-sugar melted carefully (185° C.; 365° F.) and suddenly cooled; it is amorphous, yellowish, transparent, gradually becoming crystalline and opaque externally.

3. *Caramel,* $C_{12}H_{18}O_9$.—This results from cane-sugar parting with $2H_2O$ by being heated to 204° C. (400° F.) for a short time—with a

little alkali or alkali carbonate to hasten the conversion; it is dark brown, bitter, consisting of colorless bitter caramelan, $C_{12}H_{18}O_9$, red-brown caramelene, and other compounds. Used in coloring liquid preparations.

TRITICUM. TRITICUM.

Agropyron repens, *(Linné) Beauvois.* { The dried rhizome and roots, gathered in the spring.

Habitat. Europe, N. America; along roadsides and in cultivated grounds.

Syn. Tritic., Couch Grass, Dog Grass, Cutch (Scutch, Quitch, Quick, Twitch, Squitch) Grass, Couch Wheat, Quickens, Wickens, Wick; Fr. Chiendent officinal (petit); Ger. Queckenwurzel, Graswurzel.

Ag-ro-py′ron (Agropyrum). L. fr. Gr. ἀγρός, a field, + πυρός, wheat—*i. e.*, grows wild in wheat fields.

Re′pens. L. fr. *repo*, creep, crawl—*i. e.*, stem inclines to crawl on the ground.

Trit′i-cum. L. fr. *tero, terere*, pp. *tritus*, thresh, rub, grind—*i. e.*, seeds must be ground for eating.

Plant.—Perennial weed; culm .6–1.2 M. (2–4°) high; spikes compressed, 7.5–10 Cm. (3–4′) long; spikelets 3–8-flowered, 2-ranked, alternate on opposite sides of solitary, terminal spike; glumes transverse, lanceolate, herbaceous, 3–7-nerved, pointed or awned from tip; palet flattened, bristly ciliate. Rhizome, of horizontal growth, very long, creeping, subcylindrical; usually in pieces 4–12 Mm. ($\frac{1}{6}$–$\frac{1}{2}$′) long, 1–2.5 Mm. ($\frac{1}{25}$–$\frac{1}{10}$′) thick, yellowish-brown, longitudinally furrowed, smooth, lustrous, nodes with circular leaf-scars, few root-scars, occasional slender roots; fracture tough, fibrous; internally lemon-yellow; large, hollow pith; odor slight, aromatic; taste sweetish; roots filiform, irregularly branching, 2.5–5 Cm. (1–2′) long, .5 Mm. ($\frac{1}{50}$′) thick, frequently covered with long root hairs. Powder, light yellow; microscopically—irregular, lignified fragments, many with tracheæ associated with sclerenchymatous fibres, epidermal and parenchyma fragments of rectangular cells having walls with transverse pores. *Solvents:* cold or hot water. Dose, ʒss–3 (2–12 Gm.).

Constituents.—Triticin 8 p. c., fruit-sugar 2.5–3.5 p. c., inosite, glucose, mucilage, malates, ash 2–3 p. c.; lactic acid and mannite are found in the extract as results of fermentation.

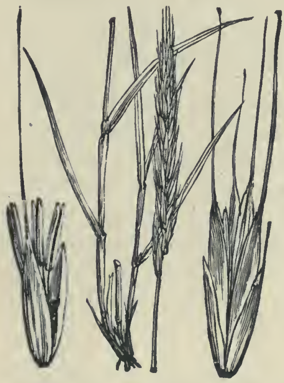


Fig. 26.—*Agropyron repens.*

Triticin.—Gum-like substance resembling inulin, convertible into levulose. Obtained by exhausting with water, neutralizing with baryta, concentrating, precipitating with lead subacetate, removing lead, treating with charcoal, neutralizing, concentrating, precipitating with alcohol; it is an amorphous, white powder, inodorous, tasteless, deliquescent, with nitric acid oxidizes into oxalic acid.

PREPARATIONS.—1. *Fluidextractum Tritici.* Fluidextract of Triticum. (Syn., Fldext. Tritic., Fluid Extract of Triticum, Fluidextract of Couch Grass; Fr. Extrait fluide de (petit) Chiendent; Ger. Queckenwurzelfluidextrakt.)

Manufacture: Mix, macerate for 2 hours in covered container 100 Gm. with boiling water 500 Ml. (Cc.), pack, percolate with boiling water until exhausted, evaporate to 80 Ml. (Cc.), cool, add alcohol 20, and, if necessary, water q. s. 100 Ml. (Cc.). Dose, ℥ss-3 (2–12 Ml. (Cc.)).

Unoff. Preps.: Decoction, 5 p. c., dose, *ad libitum. Extract,* dose, gr. 10–20 (.6–1.3 Gm.). *Infusion,* 5 p. c., dose, *ad libitum.*

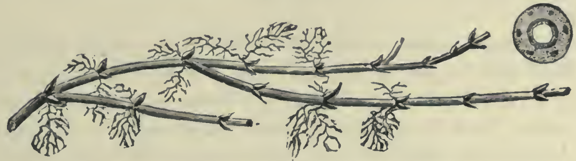


FIG. 27.—*Agropyron repens:* rhizome and transverse section, magnified 3 diam.

PROPERTIES.—Diuretic, aperient, demulcent, vulnerary.

USES.—Cystitis, irritable bladder, dysuria, gravel, jaundice, bronchitis, skin diseases, gout; relieves thirst, allays fever, promotes urination. Large and frequent drinks once considered a blood purifier.

Allied Plants:

1. *Ave'na sati'va, Avenæ Farina* (*Oatmeal*).—The meal prepared from the seed, official 1820–1880; Asia, Europe, cultivated. Plant .6–1.3 M. (2–4°) high, culm smooth, leaves linear, veined, rough, panicles loose, spikelets 2–3-flowered, paleæ (husk) cartilaginous. The grain yields when ground—oatmeal, when deprived of paleæ—groats. Oatmeal is not uniform, but is yellowish-white, gluten and husk present, bitterish starch granules polyhedric, muller-shaped. Composed of husk 25 p. c., grain 75 p. c.; the former contains fixed oil 1–1.5 p. c., sugar and gum .25–.75 p. c., proteids 2 p. c.; the latter starch 64–66 p. c., fat 5–7 p. c., proteids, 18–21 p. c. (mainly avenin), salts 1–3 p. c. Used as demulcent, laxative, dietetic, nutritive. The indigestible husks act as a mechanical irritant, exciting peristalsis, but may constipate by compaction. Given as porridge or gruel may ferment and impair digestion.

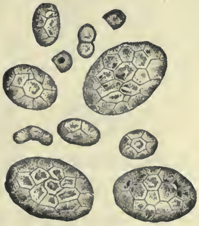


FIG. 28.—Oat starch: magnified 250 diam.

2. *Andropo'gon squarro'sa* (*murica'tus*), *Vetiveria* (*Vitivert*).—E. India. The fibrous wiry roots from the rhizome; yellowish-brown, waxy, 15–20 Cm. (6–8′) long, 1 Mm. ($\frac{1}{25}$′) thick, tough, aromatic, balsamic; contains volatile oil, resin. Used as tonic, stimulant, in perfumery, sachet powders, etc.

3. *Sor'ghum vulga're, Broom Corn.*—Fruit 4 Mm. ($\frac{1}{6}$′) long, oval, flattened, brownish-yellow. Used in decoction (10 p. c.) for cystitis, etc.

MALTUM. MALT.

Hordeum sativum, *Jessen.* { The grain of one or more varieties, partially germinated artificially, and then dried at 55° C. (131° F.).

Habitat. W. Asia, China, Egypt; cultivated.

Syn. Hordeum Decorticatum (Perlatum), Maltum Hordei, Barley Malt; Fr. Orge Perlé, Malt d'Orge, Dreche; Ger. Perlgerste, Perlgraupen, Malz, Gerstenmalz.

Hor'de-um. L. barley, classical Latin name, fr. *horrere,* bristle—*i. e.,* spikelets pointed with an awn, or of the bristle form.

Sa-ti'vum. L. *sativus,* sown, cultivated, in gardens, fields—*i. e.,* the kind used, in contradistinction to the wild-grown.

Plant.—Annual grain, culm, .6–1 M. (2–3°) high, leaves 15–37.5 Cm. (6–15') long, linear, scabrous, spike 7.5–10 Cm. (3–4') long, fruit in 2 rows, seed elliptical, 8 Mm. ($\frac{1}{3}$') long, flat back, angled sides, grooved front, smooth, grayish-yellow from adherent paleæ, when removed brownish; deprived of outer integuments (pericarp) gives "pot barley," and by partial grinding get "pearl barley," having the integuments and a portion of the kernel removed, and ends of seeds rounded off, producing grains 2.5–4 Mm. ($\frac{1}{10}$–$\frac{1}{6}$') long, and about as broad; contains starch 60–68 p. c., protein compounds (gluten, albumin) 12–16 p. c., oil 2–3 p. c., cellulose 8–12 p. c. Malt, in yellowish, amber-colored grains, crisp when fractured, interior nearly white, agreeable, characteristic odor, sweet taste, due to conversion of the starch in the seed to maltose through the action of diastase, floats in cold water; capable of converting 5 times its weight of starch into sugars. *Tests:* 1. The solid soluble constituents from evaporating aqueous infusion (5 p. c.) to dryness should be 70 p. c. of the malt taken. 2. The acidity of malt, calculated as lactic acid, should not exceed .3 p. c. *Solvent:* cold water dissolves about 70 p. c. Dose, *ad libitum.*

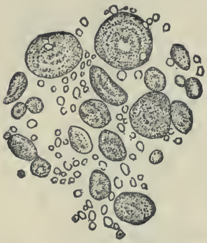


Fig. 29.—Barley starch.

Commercial. — Barley seeds are soaked in water, placed in heaps, when heat is generated spontaneously, being prevented from rising too high by occasional turning; germination takes place, and when the germ (acrospire) has acquired the proper length ($\frac{1}{3}$ of grain), the grain is dried rapidly to kill the embryo, thereby arresting further action of diastase, hence conversion of starch to maltose, sprouts removed, and thus constitutes malt. According to degree of heat used in drying will be obtained the pale, pale-amber, or amber-brown varieties; the grain increases 9 p. c. in size, but loses 20 p. c. in weight, becoming soft and easily crumbled.

Constituents.—Diastase .2–1 p. c., peptose (converts albumin to peptones), dextrose, sugar, starch.

Diastasum, Diastase. — (Syn., Fr. Diastase; Ger. Diastase.) This mixture containing amylolytic enzymes is obtained from an infusion of malt (barley, oat, wheat, potato), by adding a little alcohol (to overcome viscidity, coagulate albumin, etc.), filtering, adding alcohol sufficient to precipitate the diastase along with other substances; purify by redissolving 2–3 times in water and precipitating with alcohol. It is a yellowish-white, amorphous powder, translucent scales; odorless, tasteless: soluble in water with turbidity, insoluble in alcohol; converts starch into dextrin and maltose, and not less than 50 times its weight of potato starch into sugars; amylolytic power gradually lost on keeping, destroyed by heating its solutions above 85° C. (185° F.), or by adding much acid, and is diminished by the presence of acids or alkalies. *Taka-Diastase*, a kindred ferment, is produced by the action of the fungus, *Aspergil'lus Ory'zæ*, upon steamed rice or sterilized bran. It is a yellowish-white, hygroscopic, nearly tasteless powder, soluble in water; claimed to convert 100 times its weight of starch into sugar (glucose) within 10 minutes; used in preparing the Japanese national drink, "*Sake*," and in converting maize into sugar in the production of whisky. Dose, gr. 5–8 (.3–.5 Gm.), alone or with pepsin, usually just after meals.

PREPARATION.—1. *Extractum Malti.* Extract of Malt. (Syn., Ext. Malt.; Fr. Extrait (Essence) de Malt; Ger. Malzextrakt.)

Manufacture: Macerate for 6 hours 100 Gm. with water 100 Ml. (Cc.), add water 400 Ml. (Cc.), digest for 1 hour at 60° C. (140° F.) on water-bath, strain, express, filter, evaporate on water-bath or in vacuum apparatus at 60° C. (140° F.) until sp. gr. 1.350–1.400—consistency of thick honey; yield 65–75 p. c. It is a brownish-yellow, thick or semi-fluid liquid, slight odor, sweet, mucilaginous taste, acid reaction, soluble in water, turbid, then flocculent precipitate with alcohol, tannin, alkaloidal reagents, mercuric chloride, gradually liquefies starch-paste, which will not become blue with iodine; contains water 20–25 p. c., maltose 48–70 p. c., dextrin 2–16 p. c., diastase 1–2 p. c., proteids 8 p. c., phosphoric acid .3–.4 p. c., lactic acid .75–1.5 p. c., ash 1.5 p. c. Should be kept cool, in well-closed containers. Dose, ʒj–4 (4–15 Gm.).

PROPERTIES AND USES.—Barley: As a nutritive in bronchial affections, sore throat, febrile diseases, pulmonary and urinary disorders; Malt: Yields to cold water its active constituents (diastase .2–1 p. c., dextrin, sugar, starch), producing an infusion or wort which by adding hops and fermenting gives several kinds of malted liquors (ale, porter, lager beer, brown stout, etc.)—infusion may be used in wasting diseases, cholera infantum, diarrhœa; Extract: Good for dyspepsia, phthisis, wasting diseases, as an emulsifying agent, as a basis for cod-liver oil emulsion; dry extract as food for infants.

7. PALMACEÆ. Palm Family.

Pal-ma'se-e. L. *Palm-a* + aceæ, fem. pl. *palmaceous*, of or pertaining to the palms, fr. *palma*, a palm. Perennial trees or shrubs, mostly unbranched, growing by terminal, or edible bud. Distinguished by leaves being palmately or radiately parallel-veined, plaited, on sheathing petioles, somewhat divided on expansion; flowers small, perfect or polygamous, regular, often rigid or fleshy, frequently diœcious; perianth double, 3-merous, stamens 6, borne on branching spadix; ovary and style 3; fruit berry, drupe or dry; seed 1–3; embryo minute, albuminous; tropical climates; diuretic, expectorant, sedative, tonic; timber valuable in ships.

Genus: **1. Serenoa.**

SABAL. SABAL.

Serenoa serrulata, (*Michaux*) *Hooker filius.* } The partially dried, ripe fruit.

Habitat. S. United States, N. Carolina to Florida; sandy soil near seacoast.

Syn. Saw Palmetto Berries, Saw Palmetto, Palmetto (Scrub), Dwarf Palmetto, Fan Palm; Fr. Palmier nain; Ger. Palmettopalme, Sabal.

Sa'bal. L. fr. S. American or Mexican native name.

Se-re'no-a. L. after Professor Sereno Watson, a noted American botanist and author.

Ser-ru-la'ta. L. fr. *serrulatus, serrula,* dim. of *serra,* a saw—*i. e.,* the petioles of the leaves with spiny edges, like saw-teeth.

Saw' pal-met'to—fr. *saw,* saw-like edges of petioles, + L. *palma,* palm of the hand—*i. e.,* leaves like the outspread hand.

Plant.—Small, low shrub; stem (caudex) creeping; rhizome many feet long, 10–15 Cm. (4–6′) thick, running horizontally several feet under the surface; roots numerous, fibrous, 1.5–3 M. (5–10°) long, 12 Mm. ($\frac{1}{2}$′) thick; leaves terminal, orbicular (flabelliform) .6–1 M. (2–3°) long, in dense masses, 10–12-cleft; petioles aculeate-serrate; flowers small, white, on long woolly, branched spadix, base sheathed by spathes. Fruit, 1-seeded drupe, similar to olive, ellipsoidal, ovoid, occasionally compressed, 1.5–3 Cm. ($\frac{3}{5}$–$1\frac{1}{5}$′) long, 1–1.5 Cm. ($\frac{2}{5}$–$\frac{3}{5}$′) broad, bluish-black, brownish, smooth, somewhat oily, few large angular depressions (shriveled) from contraction of inner layer on drying, summit with scar of style, base with short stalk or stem-scar; epicarp and sarcocarp forming thin coriaceous shell enclosing hard thin endocarp, which is externally reddish-brown, somewhat fibrous as is also the inner layer of sarcocarp; inner layer of endocarp smooth, enclosing a hard, ellipsoidal, ovoid, somewhat flattened, reddish-brown seed; odor pronounced, aromatic; taste sweetish, aromatic, slightly acrid. Powder, yellowish-brown; microscopically—large irregular fragments, parenchyma cells of sarcocarp containing an amorphous substance, whitish fragments of endosperm, few nearly colorless tabular stone cells. Should be kept in tightly-closed containers, adding occasionally a few drops of chloroform or carbon tetrachloride to prevent insect attack. *Solvents:* alcohol; ether. Dose, gr. 15–60 (1–4 Gm.).

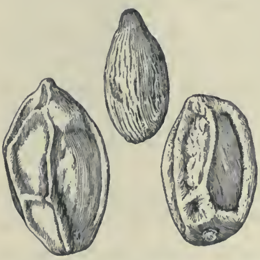


Fig. 30.—Saw Palmetto: fruit and seed.

Commercial.—Plant grows with greater exuberance near the sea, from Mosquito Inlet to Jupiter Inlet, Florida, where it forms an unbroken scrub a hundred (160 Km.) or more miles in length and several in breadth; the dense leaves with their saw-like edges render the jungles almost impenetrable by beast and man. The fruit ripens Oct.–Dec., and collection begins in August, before maturity, lasting until Jan.; after the fruit-stems are cut with pruning-shears, the fruit is shaken into baskets, a bushel weighing, when fresh, 54 pounds (25 Kg.), and when dried 30–40 pounds (13.5–19 Kg.). It is then placed in barrels and preserved for use by adding thereto a small amount of alcohol.

Constituents.—Volatile oil .5–1 p. c., Fixed oil 12–15 p. c., fat, alkaloid, resin, dextrin, glucose; seeds contain fixed oil 12 p. c.

Volatile Oil.—Not supposed to exist in the dried fruit; some claim it to be present in the recent fruit, others that it is formed by the slow action of the fatty acids on the alcohol in which the fruit is kept. It has a green color and an old-cheese odor.

Fixed Oil.—Thought to be composed of 2 portions, one being of a light lemon color, the other a greenish-brown; when combined has sp. gr. 0.885–0.914, congeals at 11.5° C. (53° F.), melts at 19.5° C. (67° F.).

Preparations.—1. *Fluidextractum Sabal.* Fluidextract of Sabal. (Syn., Fldext. Sabal, Fluid Extract of Sabal, Fluidextract of Saw Palmetto; Fr. Extrait fluide de Palmier nain; Ger. Palmettopalmefluidextrakt.)

Manufacture: Moisten, macerate for 6 hours in tightly-covered container 100 Gm. with enough 80 p. c. alcohol, pack, percolate with same menstruum until exhausted, reserve first 85 Ml. (Cc.), reclaim alcohol, evaporate to soft extract, which dissolve in the reserve, mix thoroughly, add menstruum q. s. 100 Ml. (Cc.). Dose, ♏xv–60 (1–4 Ml. (Cc.)).

Unoff. Preps.: Tincture, 20 p. c., dose, ʒj–2 (4–8 Ml. (Cc.)). *Tinctura Sabal et Santali,* 20 p. c., + sandal wood 6.5, alcohol 80 p. c. *Inhalation*—mix alcoholic solution with boiling water and inhale the vapor.

Properties.—Sedative, diuretic, expectorant, nutrient, tonic, anticatarrhal. Improves digestion, induces sleep, increases flesh, weight, and strength.

Uses.—Chronic bronchitis, phthisis, cold in the head, whooping-cough, irritated mucous membrane of the throat, nose, and larynx, cardiac asthma, diseases of glands of reproductive organs (mammæ, ovaries, prostate, testes).

Allied Plants:

1. *Metrox'ylon Rum'phii* (*Sa'gus Rum'phii*), *Pearl Sago.*—The prepared fecula, official 1820–1880; E. India Islands, Borneo, Moluccas, etc. Medium-size palm, 6–9 M. (20–30°) high, stem thick, covered with leaf-stalk remains, many pinnate leaves at apex; fruit round nut, covered with an imbricate coat, 1-seeded. The stem centre contains medullary matter like elder pith, which is obtained by felling and splitting the tree trunk, washing pith to extract the starch, which may be powdered, forming sago meal, or granulated. Each tree yields 500–600 pounds (225–270 Kg.) of sago. Pearl sago is the best, in pearl-like grains, brownish, diaphanous, unaltered granules oblong, truncate, muller-shaped, layers distinct, hilum at rounded end often cleft;

common sago (*M. Sa'gu*) is larger grained. Used as demulcent, nutrient for sick with weak digestion, fevers; it is easily digested, non-irritating, prepared by boiling 1 part in water 32, straining, flavoring. Factitious sago is made from potato starch.

2. *Dæmon'orops* (*Cal'amus*) *Dra'co, Draconis Resina* (*Dragon's Blood.*)—Borneo, Sumatra. A spontaneous resinous exudation from the ripening fruit; occurs in tears, globular pieces 4 Cm. (1$\frac{3}{5}$′) thick, cylindrical sticks .3 M. (12′) long, or in irregular cakes, dark brown, inside bright red, fracture dull, irregular, inodorous; when heated aromatic like benzoin, tasteless; contains red resin (draconin), benzoic acid or cinnamic acid, or both wanting, dracoresinotannol, dracoresin, dracoalban, ash 8–9 p. c.; mild stimulant, astringent. Used in tooth powders, plasters, varnishes.

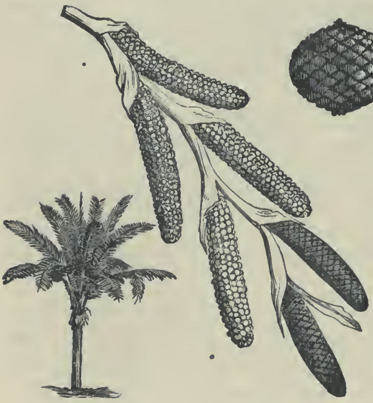


FIG. 31.—*Metroxylon Rumphii.*

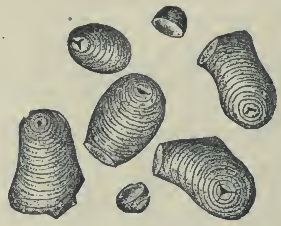


FIG. 32.—Sago starch.

3. *Ar'eca Cat'echu, Areca Nut.*—East Indies; cultivated. Large palm tree 15–18 M. (50–60°) high, fruit orange-color, size of hen's egg, contains 1 seed (nut), roundish, conical, 25 Mm. (1′) long, 9 Mm. ($\frac{3}{8}$′) thick, brown, with many reddish veins, inside horny, white, odor faint, taste astringent; contains fat 14 p. c., tannin, resin, arecoline, $C_8H_{13}NO_2$ (poisonous, tænifuge), arecaine, guvacine; astringent, tænifuge. Dose, ʒij–3 (8–12 Gm.).

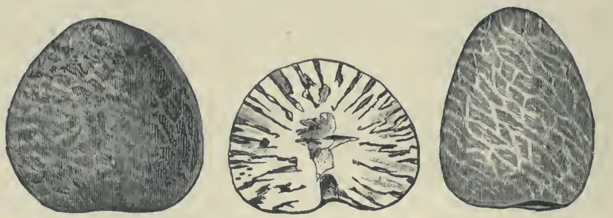


FIG. 33.—*Areca Catechu.*

4. *Elæ'is guineen'sis, Oleum Palmæ* (*Palm Oil*).—W. Africa. Heat fruit with water and express. It is a solid fat, harder than butter, orange-red, bleached by light and heat, violet odor, bland taste, fuses at 27° C. (81° F.), upon keeping acquires rancid odor and lighter color; demulcent; used in ointments, but mostly in soaps and candles.

5. *Co'cos nucif'era, Oleum Cocois* (*Cocoanut Oil*).—Tropics. A fixed oil expressed from palm seeds after being boiled with water; yield 50–60 p. c.; it is a white solid, consistence of butter, odor disagreeable, soon becoming rancid; demulcent; mostly used in soaps.

6. *Ac'orus Cal'amus, Calamus Root, Sweet Flag.*—Araceæ. The unpeeled, dried rhizome, official 1820–1910; N. America, Europe, Asia, swamps. Perennial herb; leaves, like those of *Iris versicolor*, 1–1.3 M. (3–4°) long, 2–4 Cm. ($\frac{4}{5}$–1$\frac{3}{5}$′) wide, equitant, sharp-pointed, sharp-edged; flowers on scape, spadix (spike) 5–10 Cm. (2–4′) long, 1 Cm. ($\frac{2}{5}$′) thick, minute, greenish-yellow. Rhizome, .6–1 M. (2–3°) long, 1–2 Cm. ($\frac{2}{5}$–$\frac{4}{5}$′) thick, entire or longitudinally split pieces, cylindraceous, yellowish-brown, wrinkled, annulate (remnants of leaf-sheaths), leaf-scars above, pitted root-scars beneath, fracture short, sharp, corky, spongy, whitish, showing oil cells; odor aromatic; taste pungent, bitter; solvents: alcohol, hot water partially; contains (most in cortex) volatile oil 1.5–3.5 p. c., acorin .2 p. c., choline (calamine), resin. Stimulant, carminative, tonic, bitter, aromatic; dyspepsia, colic, flatulency, coughs, flavoring. Dose, gr. 15–60 (1–4 Gm.); fluid-

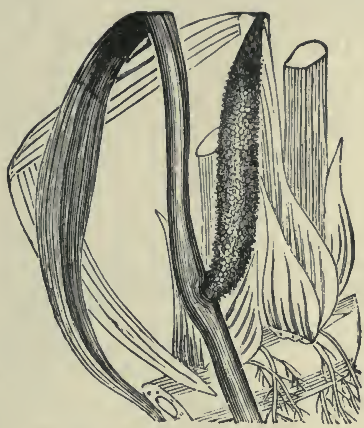


FIG. 34.—*Acorus Calamus.*

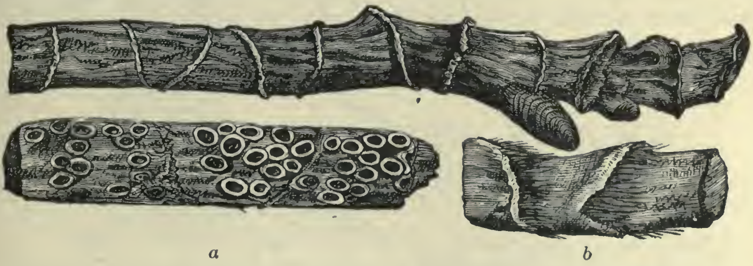


FIG. 35.—*Acorus Calamus*, rhizome: *a*, under surface; *b*, upper surface.

extract (75 p. c. alcohol), ♏xv–60 (1–4 Ml. (Cc.)); tincture 20 p. c., ʒj–2 (4–8 Ml. (Cc.)); infusion.

7. *Arisæ′ma* (*A′rum*) *triphyl′lum, Indian Turnip.*—The cormus, official 1820–1870; N. America. Plant acaulescent, leaves 2, 3-divided, 5–17.5 Cm. (2.7′) long, 2.5–7.5 Cm. (1–3′) wide. Corm 2.5–5 Cm. (1–2′) broad, brownish-gray, inside white, mealy, taste burning, acrid; contains volatile acrid principle, starch, fat, gum, resin, calcium oxalate (gives acridity). Used as stimulant, expectorant, diaphoretic, irritant for colic, flatulence, asthma, whooping-cough, chronic catarrh, rheumatism, bronchitis, aphthous sores, ringworm; in honey, syrup, ointment. Dose, gr. 5–15 (.3–1 Gm.).

8. *Spathye′ma* (*Symplocar′pus*) *fœ′tida, Skunk Cabbage.*—The dried rhizome and roots, official 1820–1880. Perennial, spathe appears first in spring, covered with purplish spots and stripes, flowers dull purple, leaves .3–.6 M. (1–2°) long, .3–.4 M. (12–15′) wide. Rhizome obconical, truncate, 7.5–10 Cm. (3–4′) long, 5 Cm. (2′) thick. Many rootlets, brownish-gray, inside whitish, many wood-bundles, whole plant fetid, more so when triturated, taste acrid, biting; contains volatile oil, gum, fat, resin, starch. Emetic, diuretic, antispasmodic, stimulant, narcotic; for asthma, chronic catarrh, rheumatism, chorea, hysteria, dropsy, bronchitis, in infusion, tincture. Dose, gr. 5–15 (.3–1 Gm.).

9. *Epiprem′num mirab′ile* (*Rhaphidoph′ora vitien′sis*—Araceæ), and *Prem′na traiten′sis, Tonga.*—Verbenaceæ; Fiji Islands. The mixed bark contains tongine (volatile alkaloid), volatile oil. Anodyne; neuralgia, rheumatism, in combination with salicylates. Dose, gr. 15–60 (1–4 Gm.).

8. MELANTHACEÆ. Bunch-flower Family.

Me-lan-tha′se-e. L. *Melanth-ium* + aceæ, fr. Gr. μέλας, black, + ἄνθος, flower—*i. e.*, alluding to the darker color which the persistent perianth assumes after blossoming. Leafy-stemmed herbs. Distinguished by being rarely bulbous; leaves grass-like, parallel-veined with transverse veinlets; perinth 6, stamens 6, ovary 3-celled, superior; fruit capsule, septicidal; seeds tailed or appendaged; temperate climates; sedative, diaphoretic, sternutatory, poisonous.

Genera: **1. Veratrum. 2. Asagræa.**

VERATRUM VIRIDE. VERATRUM VIRIDE.

Veratrum viride, *Aiton.* { The dried rhizome and roots, with not more than 5 p. c. of stems, foreign matter.

Habitat. N. America, Canada to Georgia, in rich, wet woods, swamps.

Syn. Verat. Vir., Green Hellebore, American Hellebore, American White Hellebore, Swamp or False Veratrum (Hellebore), Devil's Bite, Duckretter, Bugbane, Bugwort, Earth Gall, Indian Poke (their ordeal poison). Tickle (Itch) Weed (to bare-legged boys); Veratri Viridis Rhizoma; Fr. Vératre, vert; Ger. Grüner Germer.

Ve-ra′trum. L. *vere*, truly, + *ater*, black, dark—*i. e.*, the color of the roots of some species.

Vir′i-de. L. *viridis*, green—*i. e.*, flowers are greenish.

MELANTHACEÆ

PLANT.—Large, luxuriant, perennial herb; stem annual .6–2 M. (2–7°) high, stout, cylindrical, solid, nearly smooth, pale green,

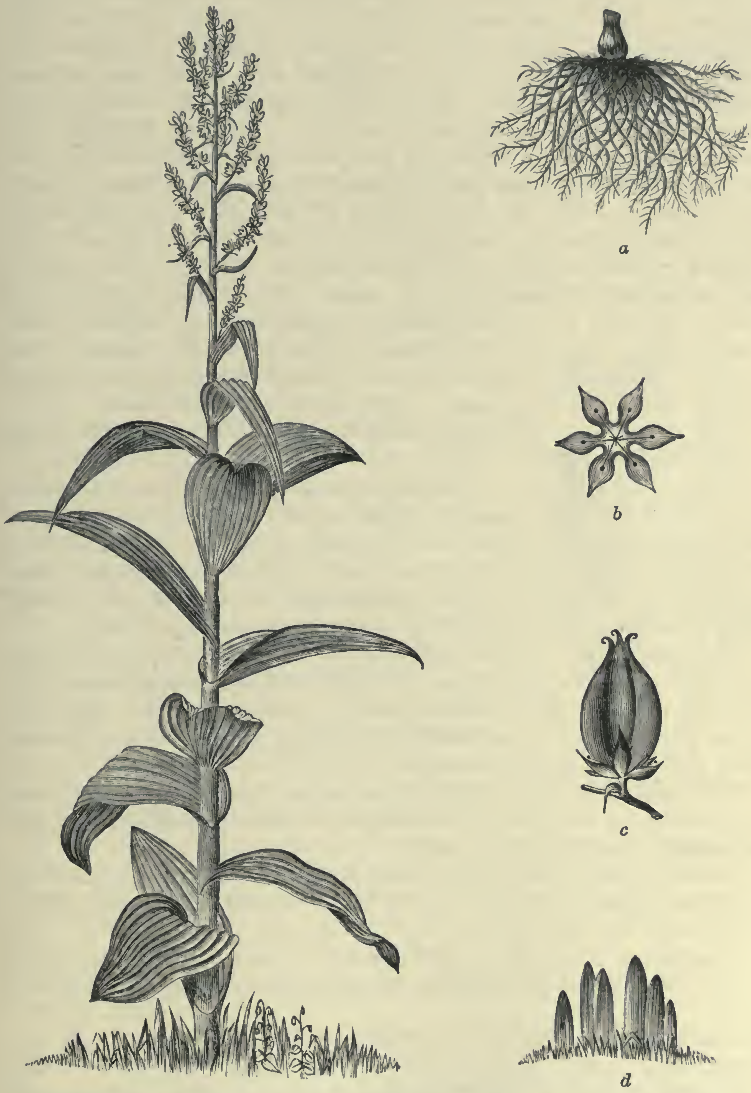


FIG. 36.—*Veratrum viride:* *a*, root; *b*, flower; *c*, ovary; *d*, plant at its early age.

unbranched except in the inflorescence; leaves 12.5–20 Cm. (5–8′) long, oblong, acuminate, sheathing the stem, plaited, nerved, pubescent; flowers May–July, many polygamous, nearly sessile, greenish-yellow, racemes with downy peduncles, sepals petaloid; fruit of 3 nearly distinct follicles 2.5 Cm. (1′) long, pericarp dry, brown, ventral dehiscence; seed flat, about 12 in each carpel. Rhizome, upright, obconical, usually cut longitudinally into 2–4 pieces, 2–7 Cm. ($\frac{4}{5}$–3′) long, 1.5–3 Cm. ($\frac{3}{5}$–1$\frac{1}{5}$′) thick, brownish, frequently numerous thin leaf-bases closely arranged at the summit, otherwise rough, wrinkled, somewhat annulate from scars or bud-scales; on outer portion numerous roots, the lower part more or less decayed; fracture hard, horny; internally grayish-white, with many irregular fibro-vascular bundles; inodorous, but sternutatory; taste bitter, acrid. Roots, subcylindrical, 3–8 Cm. (1$\frac{1}{5}$–3′) long, 1–3 Mm. ($\frac{1}{25}$–$\frac{1}{8}$′) thick, deeply transversely wrinkled; fracture short, bark whitish, thick, porous central cylinder. Powder, grayish-brown, strongly sternutatory; microscopically—numerous starch grains, .003–.02 Mm. ($\frac{1}{8325}$–$\frac{1}{1250}$′) broad, raphides of calcium oxalate, fragments with tracheæ having walls with scalariform or reticulate thickenings, often lemon-yellow content, sclerenchymatous fibres, occasional fragments of reddish-brown cork. *Solvent:* alcohol. Dose, gr. 1–4 (.06–.26 Gm.).

Adulterations.—Rhizome of allied plants, also those of *Spathyema* (*Symplocarpus*) *fœtida.*

Commercial.—Rhizome is collected chiefly in autumn, sometimes just before flowering, washed, dried, entire or sliced, and, owing to likely deterioration, should not be kept more than a year. Fresh leaves in contact with the skin often produce itching, and when carelessly gathered and cooked, as spinach, in place of marsh marigold (cowslip—*Cal′tha palus′tris*), cause very serious results.

Constituents.—Protoveratrine .03 p. c., Jervine .1 p. c., Rubijervine .005 p. c., Pseudojervine, Protoveratridine (decomposition product), Cevadine, veratramarin (bitter glucoside), jervic acid, fat, resin, gum, starch; veratroidine no longer considered an alkaloid, but a mixture of amorphous bases.

Protoveratrine, $C_{32}H_{51}NO_{11}$.—Most important; white shining crystals, soluble in chloroform, hot alcohol; solution greenish with H_2SO_4, changing to blue, violet.

Jervine, $C_{26}H_{37}NO_3$.—Most abundant; white crystals, tasteless, non-sternutatory, slightly toxic, soluble in alcohol, acetone, chloroform.

Rubijervine, $C_{26}H_{43}NO_2+H_2O$.—White prisms, distinguished from jervine by the ready solubility of its nitrate and sulphate; almost inert.

Pseudojervine, $C_{29}H_{43}NO_7$.—White crystals, soluble in alcohol; almost inert.

Preparations.—1. *Fluidextractum Veratri Viridis.* Fluidextract of Veratrum Viride. (Syn., Fldext. Verat. Vir., Fluid Extract of Veratrum Viride, Fluidextract of Green Hellebore; Fr. Extrait fluide de Vératre américain; Ger. Grüngemerfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: alcohol. Dose, ♏j–4 (.06–.26 Gm.).

2. *Tinctura Veratri Viridis.* Tincture of Veratrum Viride. (Syn., Tr. Verat. Vir., Tincture of Green (American) Hellebore; Fr. Teinture de Vératre vert: Ger. Grün Nieswurzeltinktur.)

Manufacture: 10 p. c. Moisten 10 Gm. with sufficient alcohol, transfer to percolator without pressing, let stand, well-covered, for 6 hours, pack firmly, add alcohol to saturate and cover, macerate for 24 hours, percolate with alcohol q. s. 100 Ml. (Cc.). Dose, ♏ij–10 (.13–.6 Ml. (Cc.)).

Unoff. Preps.: Extract, dose, gr. $\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 Gm.). *Dr. Norwood's Tincture*, 50 p. c., saturated, being the same strength as the official tincture of 1870, dose, ♏v–8 (.3–.5 Ml. (Cc.)).

Properties.—Sedative, emetic, diaphoretic, irritant, sternutatory, errhine. This resembles aconite very closely in action, being a cardiac depressant and spinal paralyzant. It diminishes the frequency and force of cardiac contractions, by depressing heart muscle, and stimulating inhibition (pneumogastric), depresses spinal cord, causing muscular relaxation, induces cutaneous relaxation, hence free sweating; large doses produce rapid but very feeble pulse, cold, clammy skin, vomiting, debility, giddiness, impaired vision, partial unconsciousness; it is eliminated by the bowels. Protoveratrine, the most active heart content, slows the pulse by its powerful stimulating influence upon the pneumogastric nerve, while jervine, constituting more than one-half of the total alkaloids, plays an important part in lowering arterial tension by depressing powerfully the heart and vasomotor centre; the so-called veratroidine depresses the cord, paralyzes respiration, and causes emetocatharsis, thereby often preventing fatal results.

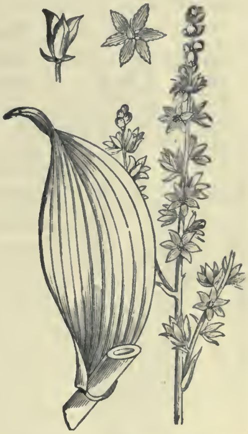


Fig. 37.—*Veratrum album.*

Uses.—To reduce arterial excitement, spinal spasms, pneumonia, cardiac diseases, typhoid fever. Always given in the commencing or inflammatory stages, heart disease, nervous palpitation, puerperal and epileptiform convulsions, tetanus, chorea, mania-a-potu, diphtheria.

Poisoning, Incompatibles, Synergists: Same as for aconite.

Allied Plant:

1. *Veratrum al'bum, White Hellebore* (*Veratrum*).—The rhizome, official 1820–1880; 1900–1910; Europe—Alps, Pyrenees, Balkans. Plant nearly identical with the official, slight variations being due possibly to climate and soil; constituents same in character and name, except there is no cevadine; the veratralbine of former writers is no longer considered an alkaloid, but a mixture of amorphous bases. Properties and uses precisely as the official.

SABADILLA. CEVADILLA.

Veratrina. Veratrine, *official.*

Asagræa officinalis,
Chamisso et Schlechtendal. } A mixture of alkaloids obtained from the seed.

Habitat. Mexico to Guatemala and Venezuela.

Syn. Veratrin., Veratria, Indian Barley-caustic; Fr. Cévadille, Veratrine officinale (amorphe); Ger. Sabadillsamen, Läussekörner, Veratrinum, Veratrin.

A-sa-græ′a. L. after Asa Gray, formerly professor of botany, Harvard University.

Of-fi-ci-na′lis L. *officina,* a workshop, = *opus,* work, + *facere,* to do, to make —*i. e.,* used in or belonging to the shop or store.

Sab-a-dil′la. L. fr. Sp. *cevadilla, cebadilla,* fr. *cibare,* to feed, *cibus,* food.

Plant.—Bulbous perennial herb, bulb ovoid, covered with numerous black scales; scape 1.2–1.5 M. (4–5°) high; leaves from bulb, linear, grass-like, .3–1.3 M. (1–4°) long, smooth, entire, strong midrib; flowers numerous, 12 Mm. ($\frac{1}{2}'$) broad, monœcious, lower ones hermaphrodite; upper staminate, greenish-yellow, racemes, 22.5–45 Cm. (9–18′) long; fruit, 3-celled capsule (3 coalescing follicles) 12 Mm. ($\frac{1}{2}'$) long, pericarp pale brown, papery, dehiscent. Seeds, 2–5 in each follicle, dark brown, fusiform, compressed, 6 Mm. ($\frac{1}{4}'$) long, slightly winged above, angular, testa thin, rugosely wrinkled, albumin whitish, oily, inodorous, bitter, acrid, sternutatory. Dose, gr. 1–4 (.06–.26 Gm.).

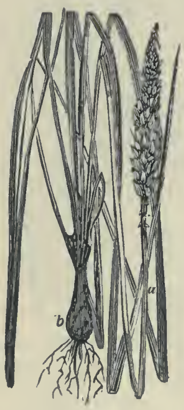


Fig. 38.—*Asagræa officinalis:* *a,* fruit-bearing stem; *b,* root, bulb, and leaves.

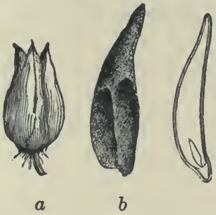


Fig. 39.—Sabadilla: *a,* fruit, natural size; *b,* seed and longitudinal section, magnified.

Commercial.—Sabadilla seeds no longer are supposed to come from *Veratrum Sabadilla,* but are the recognized product chiefly of *Asagræa officinalis* (*Schœnocau′lon officina′le. Veratrum officinale, Helo′nias officinalis*). They formerly entered commerce solely from Vera Cruz, being derived from cultivated Mexican plants, but now are shipped chiefly from La Guayra, the port of Caracas, and Venezuela; the ripe capsules from Mexico.

Constituents.—Veratrine (Cevadine, $C_{32}H_{49}NO_9$ + Veratridine, $C_{37}H_{53}NO_{11}$), cevadilline, $C_{34}H_{53}NO_8$, sabadine, $C_{29}H_{51}NO_8$, sabadinine, $C_{27}H_{43}NO_8$, angelic acid, $C_5H_8O_2$, methyl-crotonic acid, $C_5H_8O_2$, cevadic acid, veratric acid, fixed oil, ash 3.5 p. c.

MELANTHACEÆ

Veratrina. Veratrine, $C_{37}H_{53}NO_{11}$.—This mixture of alkaloids is obtained by exhausting seeds with alcohol, evaporating to syrupy consistency, adding water to remove resin, oil, coloring matter, etc., precipitating the filtrate containing veratrine veratrate with ammonia water in excess; or may boil alcoholic extract in acidulated water (HCl or H_2SO_4), decompose with magnesium oxide, take up alkaloids with acidified alcohol, evaporate, filter through animal charcoal, precipitate with ammonia water. Commercial or medicinal veratrine usually consists of veratrine, cevadine (most important, sternutatory, with potassium hydroxide splitting into methyl-crotonic acid and amorphous cevine, $C_{27}H_{43}NO_8$), veratridine, cevadilline (amorphous, insoluble in ether, benzene), sabadine (non-sternutatory, crystallizes from ether in needles and, like the preceding alkaloids, is colored yellow, then red by sulphuric acid), sabadinine (resembles sabadine, but turns red at once with sulphuric acid), and their derivatives. It is a white, or grayish-white, amorphous powder, odorless, but causing, when even a minute quantity reaches the nasal mucous membrane, intense irritation and sneezing; must use great caution in tasting; slightly hygroscopic, soluble in water (1760), hot water (1345), alcohol (2.8), chloroform (.7), ether (4.2), insoluble in purified petroleum benzin; alcoholic solution alkaline; incinerate .1 Gm.—ash non-weighable. *Tests:* 1. Triturate .05 Gm. with sulphuric acid 2 Ml. (Cc.)—yellow, orange-red solution, but by reflected light—greenish fluorescence, intensified upon adding equal volume of sulphuric acid; on standing—deep red color. 2. Heat with sulphuric acid—cherry-red color; .1 Gm. + sugar .6 Gm. with sulphuric acid—green color, changing to blue, finally colorless. *Impurities:* Various foreign alkaloids. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{32}$–$\frac{1}{12}$ (.002–.005 Gm.).

PREPARATIONS.—(Unoff.): *Oleate* (2 p. c., + olive oil 48 p. c., oleic acid 50 p. c.); used externally. *Ointment* (4 p. c., + expressed oil of almond 6 p. c., benzoinated lard 90 p. c.); used externally.

PROPERTIES.—Sedative, powerful irritant, sternutatory, errhine. Locally—gives heat, pain, redness, numbness. Internally—causes burning sensation, free salivation, great depression, reduces force and rate of pulse; large doses make the contractions few, each lasting a long time, until heart stops in systole. When poisoned, have muscular weakness, nausea, vomiting, purging, debility, giddiness, impaired vision, partial unconsciousness, violent convulsions, muscular paralysis, seldom kills, if so, from heart paralysis.

USES.—Chiefly externally—neuralgia, headache, sciatica, pruritus, pediculi, acute articular rheumatism, pneumonia, epilepsy, chronic swellings, stiff, indurated sprains. For these it may be applied in fat or alcohol (1–5 p. c.), using gr. 2–4 (.13–.26 Gm.) per day, but never on abraded surface. Internally—for heart trouble, cardiac dropsies, gout, rheumatism fevers, inflammations, dysmenorrhœa. Now little used, owing to its dangerous depressing and uncertain action, as aconitine can well be substituted for it.

Poisoning, Incompatibles, Synergists: Same as for aconite.

9. LILIACEÆ. Lily Family.

Lil-i-a′se-e. L. *Lili-um* + aceæ, a lily, fr. Celtic *li*, whiteness, alluding to beautiful white flowers of original species. Herbs, shrubs, trees. Distinguished by having bulbs, rhizomes, tubers, or fibrous roots; leaves parallel-veined; flowers regular symmetrical, 6-androus, perianth non-glumaceous, petaloid, free from 3-celled, superior ovary; anthers 2-celled; fruit many- or few-seeded pod or berry; temperate climates, tropics; purgatives, emetic, diuretic, diaphoretic, stimulant, astringent, acrid; fibres, food, condiment.

Genera: **1. Urginea. 2. Aloe.**

SCILLA. SQUILL.

Urginea maritima, *(Linné) Baker.* { The fleshy, inner scales of the bulb of the white variety, cut into pieces and carefully dried.

Habitat. Mediterranean Basin, near the sea; Spain, France, Italy, Greece, Portugal, Morocco, Algeria; in dry, sandy, also hilly localities.

Syn. Scill., Sea Onion, White or Red Squills; Fr. Scille, Squille; Ger. Bulbus Scillæ, Meerzwiebel.

Ur-gin′e-a. L. *urgere*, to press, urge—*i. e.*, its flattened, compressed seeds; or fr. Algerian Arab tribe *Ben urgin.*

Ma-rit′i-ma. L. *maritimus*, of the sea, maritime—*i. e.*, its habitat near the sea.

Scil′la. L. fr. Gr. σκίζειν, to split—*i. e.*, splits into scales; σκίλλα, an onion.

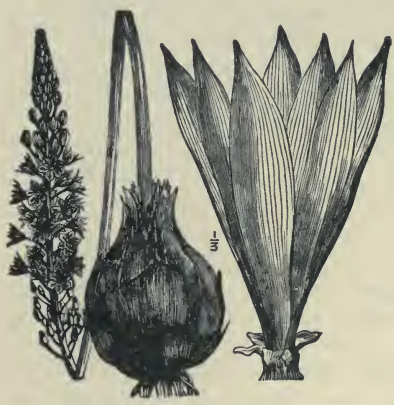


Fig. 40.—*Urginea maritima.*

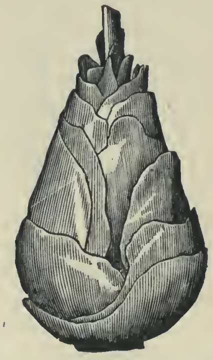


Fig. 41.—Scilla bulb, prepared for slicing.

Plant.—Perennial herb; roots fibrous from base of large bulb; leaves appear long after flowers, several, .5–.6 M. ($1\frac{1}{2}$–2°) long, shining, deep green; flowers white, on succulent stem, .3–1 M. (1–3°) high, in close spike, no calyx, peduncles purplish; fruit, dry capsule 12 Mm. ($\frac{1}{2}'$) long, oblong, 3-lobed, yellow, seeds 6 in each cell, 6 Mm. ($\frac{1}{4}'$) long, flattened, purplish-brown. Bulb scales, in irregular, more or less curved, slightly flattened pieces, .5–5 Cm. ($\frac{1}{5}$–2′) long, yellowish-white, somewhat translucent, nearly smooth and lustrous with slight projections of fibro-vascular bundles, brittle (dry), flexible (damp); odor slight; taste bitter, acrid. Powder, yellowish-white, caking in moist air; microscopically—irregular fragments, numerous single crystals and bundles of long raphides of calcium oxalate; fragments of colorless parenchyma often with dark intercellular spaces due to inclusion of air; few fragments with reticulate tracheæ. Should be kept dry, in tightly-closed containers. *Solvents:* alcohol (75 p. c.); diluted acetic acid; vinegar; water. Dose, gr. 1–5 (.06–.3 Gm.), ter die until nauseated; gr. 5–10 (.3–.6 Gm.) usually will cause vomiting.

Commercial.—Plant recognized a valuable medicine from early times, but first cultivated in Europe, 1630; flowers in autumn, while leaves appear in the following spring. Bulb, size of fist to child's head, often weighing 4 pounds (1.8 Kg.), grows half-immersed in the soil, being collected in August, deprived of dry outer scales and central portion (this latter of youngest growth and deficient activity), cut transversely into thin slices, and, owing to mucilaginous and hygroscopic qualities, dried carefully (negligence here yielding always inferior product), then packed in casks and shipped from Malta. When fresh abounds in viscid, acrid juice, which on handling produces excoriation with intolerable itching—a property lost upon drying without medicinal impairment. There are two kinds: 1, *White* (white scales); 2, *Red* (reddish-brown scales), both possessing identical properties, the former, however, being preferred, as it yields less colored solutions; loses on drying 80 p. c., and on exposure reabsorbs 11 p. c. of moisture, becoming moldy, hence the necessity of dry preservation.

Constituents.—Scillitin (scillipicrin, scillitoxin, scillin), Sinistrin, sugar 22 p. c., volatile oil, calcium oxalate 3–8 p. c., ash 3 p. c.

Scillitin.—Bitter principle, upon which activity depends, but it has never been obtained pure. Dose, gr. $\frac{1}{6}$–$\frac{1}{2}$ (.01–.03 Gm.). Instead of this, Merck gives 3 active principles:

(1) **Scillipicrin.**—Bitter principle, yellowish-white, amorphous, soluble in water, hygroscopic; acts upon the kidneys. Dose, gr. $\frac{1}{3}$–1 (.02–.06 Gm.).

(2) **Sillitoxin (Scillain).**—Glucoside, brown, bitter, burning taste, amorphous, insoluble in water, ether, soluble in alcohol; acts upon kidneys and heart. Dose, gr. $\frac{1}{60}$–$\frac{1}{30}$ (.001–.002 Gm.).

(3) **Scillin.**—Crystalline, pale yellow, soluble in alcohol, hot ether; benumbs, induces vomiting. S. Wanizewski has suggested the following names for the active principles: (1) Scillapicrine, soluble in water, alcohol; (2) Scillamarine, soluble in chloroform, alcohol; (3) Scillinine, soluble in alcohol, insoluble in water, chloroform.

Sinistrin, $C_6H_{10}O_5$.—White mucilage, resembles dextrin, lævorotatory, easily converted into levulose by boiling with diluted sulphuric acid.

Preparations.—1. *Acetum Scillæ.* Vinegar of Squill. (Syn., Acet. Scill.; Fr. Vinaigre (Acétolé) de Scille—scillitique; Ger. Meerzwiebelessig.)

Manufacture: 10 p. c. Macerate for 7 days, shaking frequently, 10 Gm. with diluted acetic acid q. s. 100 Ml. (Cc.), strain, heat to boiling, filter. Dose, ♏v–30 (.3–2 Ml. (Cc.)).

Prep.: 1. *Syrupus Scillæ.* Syrup of Squill. (Syn., Syr. Scill., Syrupus Aceti Scillæ; Fr. Sirop de Scille; Ger. Meerzwiebelsirup.)

Manufacture: 4.5 p. c. Dissolve, with gentle heat, sugar 80 Gm. in vinegar of squill 45 Ml. (Cc.), strain, cool, add through strainer water q. s. 100 Ml. (Cc.), mix thoroughly. Dose, ʒss–1 (2–4 Ml. (Cc.)).

2. *Fluidextractum Scillæ.* Fluidextract of Squill. (Syn., Fldext. Scill., Fluid Extract of Squill, Extractum Scillæ Fluidum; Fr. Extrait fluide de Scille; Ger. Meerzwiebelfluidextrakt.)

Manufacture: Macerate for 2 hours 100 Gm. with a portion of alcohol 200 Ml. (Cc.) + water 100 Ml. (Cc.), pack, macerate for 48 hours, percolate with menstruum until 100 Ml. (Cc.) obtained; close lower orifice, macerate for 12 hours, collect a second 100 Ml. (Cc.), again interrupt percolation for 12 hours, and continue percolation until total percolate 500 Ml. (Cc.); reclaim alcohol, evaporate to 80 Ml. (Cc.), cool, add alcohol 200 Ml. (Cc.), set aside for 12 hours, decant supernatant liquid from the syrupy layer, filter the former, wash the latter twice with 80 p. c. alcohol 30 Ml. (Cc.), adding washings through filter to previously collected alcoholic liquid, reclaim combined alcoholic liquid to 80 Ml. (Cc.), add diluted alcohol q. s. 100 Ml. (Cc.). Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

Prep.: 1. *Syrupus Scillæ Compositus.* Compound Syrup of Squill. (Syn., Syr. Scill. Co., Hive Syrup, Croup Syrup; Fr. Sirop de Scille composé; Ger. Zusammengesetzter Meerzwiebelsirup.)

Manufacture: 8 p. c. Dissolve with heat, antimony and potassium tartrate .2 Gm. in distilled water 1 Ml. (Cc.), add this to syrup 75 Ml. (Cc.), mix thoroughly, gradually add fluidextract of squill and fluidextract of senega each 8 Ml. (Cc.) previously mixed, add syrup q. s. 100 Ml. (Cc.). Dose, ♏v–60 (.3–4 Ml. (Cc.)). Cox's Hive Syrup differs from this preparation only in the use of honey instead of sugar as the preservative.

3. *Tinctura Scillæ.* Tincture of Squill. (Syn., Tr. Scill.; Fr. Teinture de Scille; Ger. Meerzwiebeltinktur.)

Manufacture: 10 p. c. Menstruum 75 p. c. alcohol—moisten squill 10 Gm. with sufficient menstruum, macerate in closed vessel in moderately warm place for 24 hours, stirring occasionally, transfer to percolator, shake down evenly without packing, add menstruum, macerate for 24 hours, proceed slowly, gradually adding menstruum q. s. 100 Ml. (Cc.). Dose, ♏v–30 (.3–2 Ml. (Cc.)).

Unoff. Preps.: Acetic Extract, dose, gr. $\frac{1}{6}$–2 (.01–.13 Gm.). *Oxymel Scillæ*—vinegar of squill 50 Gm., clarified honey 100, reduce (heat) to 100. *Pilula Scillæ Composita* (Br.).

PROPERTIES.—Resembles digitalis; expectorant, diuretic, emetic, cardiac stimulant, cathartic, irritant. Large doses irritant poison, causing gastro-enteritis, strangury, bloody urine, convulsions, death by heart paralysis.

USES.—Expectorant in croup, irritant coughs, whooping-cough, bronchitis, asthma, associated with ipecac, ammonia, asafetida, benzoin, etc. Owing to its irritating properties should not be given in acute stage. Diuretic in dropsies from cardiac disease, when it should be combined with digitalis or saline diuretics. Give to children with croup until nausea and vomiting occur. The Greeks, Romans, and Arabians used it in dropsies, ulcerated gums and throat, weak digestion. Fresh juice applied to abrasions is diuretic; to healthy skin rubefacient, which may be due to calcium oxalate needle-shaped crystals or to contained acrid resinoid—here also get ultimately the diuretic effect.

Poisoning: Similar to digitalis. Evacuate stomach, give tannin, demulcents, opiates, stimulants, etc.

Allied Plants:

1. *Al'lium sati'vum, Garlic.*—The fresh bulb without drying, official 1820–1900; C. Asia, S. Europe. Bulbous plant, .6 M. (2°) high; leaves long, flat, grass-like; flowers small, white, umbels. Bulb, subglobular, compounded of 8-wedged bulblets, covered by several membranous scales; odor pungent, alliaceous; taste warm, acrid; contains volatile oil .25 p. c., mucilage 35 p. c., albumin, sugar, starch, water 60 p. c. Stimulant, carminative, condiment, diuretic, expectorant, rubefacient; bronchitis, indigestion, infantile catarrh; poultice in catarrhal pneumonia, abscesses, earache, convulsions of children, insect and serpent wounds. Dose, ʒss–1 (2–4 Gm.); syrup, 20 p. c., ʒj–4 (4–15 Ml. (Cc.)); volatile oil, ♏j–5 (.06–.3 Ml. (Cc.)).

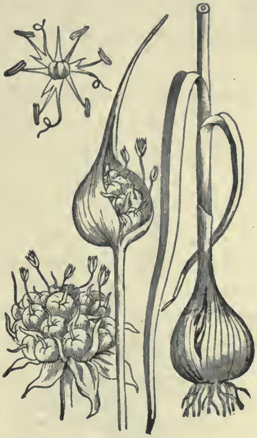


FIG. 42.—*Allium sativum.*

2. *A. Ce'pa, Onion,* and *A. Por'rum, Leek,* both used like garlic.

ALOE. ALOES.

Aloe { **Perryi,** *Baker,*
vera, (*Linné*) *Webb,* } The inspissated juice of the leaves.
ferox, *Miller.*

Hábitat. 1. E. Africa, Island of Socotra; cultivated. 2. W. Indies (N. E. Africa, India): cultivated in Curaçao, Aruba, Bonaire, Italy, Sicily, Malta, naturalized in Barbados Island, etc. 3. Cape of Good Hope (S. Africa).

Syn. 1. Aloe Socotrina, Socotrine (*sucus citrinus*)-, Bombay-, Mocha-, Turkey-, Zanzibar-Aloes; Fr. Aloès; Ger. Aloë, Aloe, Socotra Aloe, Socotrinische Aloe. 2. Aloe Barbadensis, Barbados-, Curaçao-, East Indian-, India-, Bitter-, Hepatic-, Horse-Aloes; Fr. Aloès hépatique des Barbades, ou de la Jamaique; Ger. Barbados Aloe. 3. Aloe Capensis, Aloe lucida, Shining (Glassy) Aloes; Fr. Aloes du Cap; Ger. Kapaloe.

Al'o-e. L. fr. Ar. *Alloeh,* Gr. ἀλόη, native names for the aloe.

Per′ry-i. L. after Wykeham Perry, who studied the plant natively.
Ve′ra. L. *verus*, true—*i. e.*, the original and true primitive kind.
Fer′ox. L. fr. *ferox* or *ferus*, fierce, coarse, wild—*i. e.*, large plant with leaves prickly on surface as well as margins.

PLANTS.—Perennials; stems 1.5 M. (5°) high, woody, rough from leaf-remnants; leaves glaucous-green, often with darker spots, thick, succulent, bayonet-shaped, margin with reddish spines or serratures; flowers racemose or spicate, tubular, yellowish, orange-red; stamens 6, unequal, 3 longer than corolla. INSPISSATED JUICE (aloes — *A. Perryi*): *Socotrine*, blackish-brown, opaque, or smooth glistening masses, fracture conchoidal, sometimes soft; odor aromatic, saffron-like, never fetid, putrid; taste nauseous, bitter; 50 p. c. soluble in cold water (yellow); with nitric acid—yellowish, reddish-brown solution; (*A. vera*): *Curaçao*, blackish-brown, opaque masses, fracture uneven, waxy, resinous; odor characteristic, not aromatic; 60 p. c. soluble in cold water (purplish-red); with nitric acid—deep red solution; (*A. ferox*): *Cape*, reddish-brown, olive-black masses, usually covered with yellowish powder, in thin transparent, reddish-brown fragments, fracture smooth, glassy; odor characteristic; 60 p. c. soluble in cold water (pale yellow); with nitric acid—reddish-brown solution, changing to purplish-brown, greenish. POWDER, (1) dark brown, (2) reddish-brown, (3) greenish-yellow, brown by age; microscopically (in almond oil)—(1) yellowish, reddish-brown irregular, angular fragments, (2) reddish-brown irregular, angular more or less opaque fragments, (3) bright yellow angular fragments. *Tests:* 1. Heat gently 1 Gm. with alcohol 50 Ml. (Cc.), cool—nearly clear solution (abs. of gum., inorganic

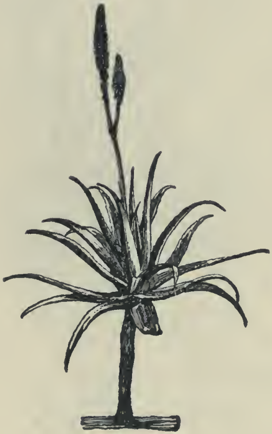


FIG. 43.—*Aloe Perryi.*

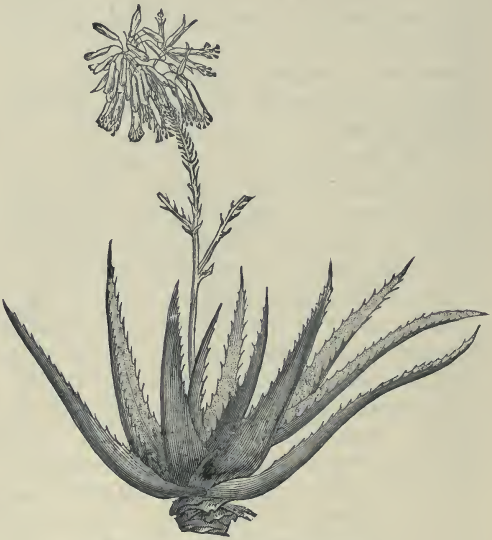


FIG. 44.—*Aloe vera (vulgaris).*

substances); evaporate—moisture 10 p. c. 2. Mix 1 Gm. with hot water 10 Ml. (Cc.); of this take 1 Ml. (Cc.), + water (100), + aqueous solution of sodium borate (1 in 20)—green fluorescence; of this take 1 Ml. (Cc.), + water (100), + benzene (10), shake, separate benzene solution, + ammonia water (5)—permanent deep rose color in lower layer. *Solvents:* alcohol; boiling water; cold water (4); not affected by ether, chloroform. Dose, gr. ½–10 (.03–.6 Gm.).

ADULTERATIONS.—ALOES: Chiefly dried juice of inferior allied species, small amount of leaves, wood, sticks, stones, leather, monkey and goat skins, implements, knives, nails, iron, resin, pitch, ochre, burned bones, gum, licorice, etc.—5–27 p. c., increasing ash to 26.5 p. c. ALOIN: Resinous and other matter, recognized by imperfect solubility in water.

Commercial.—Plants resemble to some extent *Aga've america'na,* American Aloe or century plant, and were known to Dioscorides and Celsus. The large, thick leaves have a central insipid, thick, mucilaginous juice as well as a peripheral bitter, watery, colorless juice (aloetic) in distinct, elongated, thin-walled ducts, which varies in activity with age of leaf and season of year. This superficial juice—possibly a plant protection—is collected when not too scanty or watery, March–April, just after the rainy season, by cutting off the leaves near their base, during sunshine, and standing them up for half an hour in skins depressed in the ground, or in a series of 5 V–shaped wooden troughs (1.2 M.; 4° long—.3–.5 M.; 12–18′ deep), each with an opening in the lower inclined end to run off juice as it exudes by gravity alone (any pressure serving to expel also the undesirable central juice, possessing emmenagogue properties and suitable for poultices) into iron or copper vessels for evaporation, which continues 5 hours, occasionally ladling out the impurities. The colorless juice on exposure soon becomes yellowish-brown, but may be kept in barrels for months, as it does not spoil, and according to demand reduced slowly by sun (socotrine) or rapidly by fire (curaçao, cape), thus imparting a heavier odor without injuring medicinal properties. In Curaçao immediate evaporation, below the boiling point, yields a variety called "Capey," from its lustre and yellowish powder, but if evaporation is deferred a year the surface is dull, odor suggestive of fermentation; powder brownish, and less soluble in water (4–13 p. c.). When of proper consistence the evaporated product—commercial aloes—is poured into tin-lined boxes, kegs, casks, tubs, monkey or goat skins and sent via Zanzibar to Bombay (socotrine), or into gourds (2–15–50 pounds; 1–7–23 Kg.), boxes (60–100 pounds; 27–46 Kg.), small calabashes and shipped from Curaçao, Bonaire, Jamaica, Barbadoes (curaçao), or into boxes, cases, skins, and shipped from Algoa Bay, Cape Town, Mossel Bay (cape). There are three varieties: 1, *Socotrine* (*A. Perryi*), most expensive, highly esteemed and flavored—the best; 2, *Curaçao* (*Barbadoes—A. vera* (*vulgaris*)), mostly used, and commands a higher price upon keeping; 3, *Cape* (*A. ferox*), production equals all other varieties combined; not used much in this country, but largely in Germany, S. Europe.

Constituents.—Aloin, Resin 30–50 p. c., Emodin (Cape and Barbadoes) .15–2 p. c., volatile oil (to which disagreeable odor is due) .0015 p. c., moisture 5–10 p. c., ash 1–4 p. c.

Aloinum. Aloin, *official.*—A pentoside or mixture of pentosides from aloes, varying in chemical composition, physical and chemical properties according to source. Obtained chiefly by dissolving Curaçao aloes (1) in boiling acidulated, HCl or H_2SO_4, water (10), letting stand 24 hours for resin to deposit, decanting, evaporating to 2 parts, setting aside 2 weeks to crystallize—yield 20–25 p. c. It is a micro-crystalline powder, minute acicular crystals, lemon-yellow, darker on exposure, odorless, slight odor of aloes, intensely bitter taste; varies in solubility with its composition—soluble in water, alcohol, acetone, slightly in ether. *Tests:* 1. Aqueous solution — yellow, brown on standing neutral, faintly acid. 2. Dissolves in alkaline hydroxide solutions—red, yellow becoming red, green fluorescence. 3. Decomposes when added to alkaline or acid solutions; alcoholic solution + a drop of ferric chloride T. S.—brownish-green; incinerate .5 Gm.—ash .5 p. c.; insoluble residue in water dried − 1.5 p. c. 4. Shake 1 Gm. + benzene 10 Ml. (Cc.)—filtrate imparts faint pink color to equal volume of 5 p. c. ammonia water (lim. of emodin). Curaçao-aloin, $C_{17}H_{20}O_7$, identical with barb-aloin, ugand-aloin, cap-aloin, when boiled with nitric acid—chrysammic acid, crimson color; soc-aloin, $C_{15}H_{16}O_7$, with nitric acid—no color change; nat-aloin dissolved in sulphuric acid in proximity to glass rod dipped into nitric acid—solution green, blue, violet, orange-red—but no effect on the two preceding. Twice as active as aloes and usually produces no griping. Dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.).

Resin.—Obtained by allowing a dilute aloetic infusion to cool, when it precipitates, filtering, drying. Like aloin, varies according to source, the several kinds being esters of various acids (cinnamic, paracumaric, etc.) with aloresino-tannol; soluble in hot water (thus differing from other resins), alcohol, ether, alkaline solutions, brownish-black by ferric salts; equally active as the drug, due possibly to accidental presence of aloin.

Emodin (*Aloe-emodin*).—Believed to be in Cape and Barbadoes, but not in Natal or Socotrine, and is obtained by dissolving it in ether from aloin, of which, as well as of aloes, it is the purgative principle. In aloin, just as in anthraglucosennin, rheïn, frangulin, and purshianin, the alkaline secretions of the upper intestine must produce decomposition, whereby the emodin thus set free may produce peristalsis, hence the cathartic action of the drug.

Preparations.—1. *Pilulæ Aloes.* Pills of Aloes. (Syn., Pil. Aloes; Br. Pilula Aloes, Aloes Pill; Fr. Pilules d'Aloès et de Savon; Ger. Aloepillen.)

Manufacture: Mix aloes 13 Gm., soap 13 Gm., water q. s. 100 pills. Dose, 1–4 pills.

2. *Tinctura Aloes.* Tincture of Aloes. (Syn., Tr. Aloes; Fr. Teinture d'Aloès; Ger. Aloetinktur.)

Manufacture: 10 p. c. Macerate aloes 10 Gm., glycyrrhiza 20 Gm. with diluted alcohol 75 Ml. (Cc.), in a stoppered container in a moderately warm place until exhausted (3 days), frequently agitating, drain on filter, wash residue with diluted alcohol q. s. 100 Ml. (Cc.). Dose, ʒss–2 (2–8 Ml. (Cc.)).

3. *Extractum Colocynthidis Compositum,* 50 p. c. 4. *Pilulæ Rhei Compositæ,* 1½ gr. (.1 Gm.). 5. *Tinctura Benzoini Composita,* 2 p. c.

Unoff. Preps.: Decoctum Aloes Compositum (Br.—1 p. c. of extract). *Extract,* dose, gr. ½–5 (.03–.3 Gm.). *Pills of Aloes and Iron,* 1 gr. (.06 Gm.). *Pills of Aloes and Mastic,* gr. 2 (.13 Gm.). *Pills of Aloes and Myrrh,* gr. 2 (.13 Gm.). *Pills of Aloin, Belladonna, and Strychnine* (*Compound Laxative Pills*—aloin ⅕ gr. (.013 Gm.). *Pills of Aloin Comp.,* ½ gr. (.03 Gm.). *Powder of Aloes and Canella, Hiera Picra,* 80 p. c., + canella 20 p. c., dose gr. 15–30 (1–2 Gm.). *Tincture Aloes and Myrrh,* 10 p. c., dose, ʒss–2 (2–8 Ml. (Cc.)). *Wine.*

PROPERTIES.—Cathartic, drastic, emmenagogue, vermifuge, stomachic. The action is especially on the colon and lower half of the large intestine, and thus causes irritation to uterus and inflamed hemorrhoids; stimulates the functions of the liver, intestinal secretions generally, increases the flow of bile, and acts in about 15 hours. Abnormal doses do not produce proportionately excessive results, but invariably cause tormina, tenesmus with heat, and rectal irritation—the latter (stomach and rectum) being remedied largely by combining with soap or an alkaline carbonate.

USES.—Costiveness (dependent upon weakness of muscular layer of the large intestine), atonic dyspepsia, jaundice, non-active hemorrhoids, amenorrhœa, ascarides; for the two last may give by enema.

Poisoning: Have irritation of intestinal canal, causing pain, vomiting, and purging, cold sweats, prostration, sometimes convulsions, collapse. Empty stomach, give demulcents, opium, stimulants, artificial heat to body and extremities, hot fomentations to abdomen.

Allied Products:

1. *Hepatic Aloes.*—This name was applied formerly to a variety of Socotrine aloes from E. Indies, but now the term is given in this country to Barbadoes, in fact to any opaque liver-colored aloes.

2. *Natal Aloes.*—This has a greenish-slate hue, crystalline, fracture less shining than, but odor of Cape aloes; it is of little value, and is shipped from Port Natal.

3. *Moka Aloes.*—This has brownish-black color, irregular fracture, disagreeable odor, and is from the interior of Arabia.

4. *Caballine* or *Horse Aloes.*—This is inferior, impure, having a dark color, fetid odor, being from irregular sources.

5. *Jafferabad Aloes.*—This has black-pitch color and lustre, glassy, porous fracture, and is less agreeable than Socotrine aloes.

Allied Plant:

1. *Erythro'nium america'num, Yellow Adder's-tongue.*—The root and herb, official 1820–1850; United States. Perennial herb, scape 15–22.5 Cm. (6–9′) high, slender, leaves 2, pale green, equal length

12.5 Cm. (5′), one twice as wide as the other, brown-spotted, flowers yellow, 2.5–5 Cm. (1–2′) long, root (bulb or corm) solid, brown; inside white. All parts of the plant active; used like colchicum. Dose, gr. 20–30 (1.3–2 Gm.) in infusion. Large doses emetic.

10. CONVALLARIACEÆ. Lily-of-the-Valley Family.

Kon-va-la-ri-a′se-e. L. *Convallari-a* + aceæ, fr. L. *con*, together, + *vallis*, valley—a valley enclosed on all sides—*i. e.*, alluding to the preferred place of growth of some species. Leafy-stemmed, erect herbs. Distinguished by having branched rootstocks, never bulbs or corms; leaves broad, parallel-veined, perianth 6-lobed or toothed, stamens 6, ovary 2–3-celled, superior; fruit fleshy berry, stigma 3-lobed; temperate climates; purgative, emetic, diuretic, diaphoretic, alterative, poisonous.

Genus: **1. Colchicum.**

COLCHICUM. COLCHICUM.

1. Colchici Cormus. Colchicum Corm.
2. Colchici Semen. Colchicum Seed.

Colchicum autumnale, *Linné.*
1. The dried corm, containing .35 p. c. of colchicine.
2. The dried seeds, containing .45 p. c. of colchicine.

Habitat. C. and S. Europe, N. Africa (England, Greece, Turkey, Switzerland); moist pastures and meadows.

Syn. Colch. Corm., Colchicum Root, Colch. Sem., Meadow Saffron, Naked Ladies, Autumn-, Fog-, Meadow-, Michaelmas-, or Purple-Crocus, Upstart, Bulbus (Tuber) Colchici; Colchici Radix; Colchici Semina; Fr. Colchique, Safran bâtard, Bulbe de Colchique—de Safran bâtard, Semences de Colchique; Ger. Semen Colchici, Zeitlosensamen, Herbstzeitlose, Wiesensafran, Zeitlosenknollen.

Col′chi-cum. L. fr. Gr. κολχίς, Colchis. An ancient province in Asia Minor, east of Black Sea, where this poisonous plant flourished; also the home of Media, the sorceress and poisoner of ancient legend.

Au-tum-na′le.—L. *au(c)tumnalis*, belonging or peculiar to autumn—*i. e.*, the plant blooms Sept.–Oct., covering meadows with saffron-colored flowers resembling a carpet.

Plant.—Bulbous perennial, several inches high; leaves radical, 3–5, sheathing 15–30 Cm. (6–12′) long, 2.5–5 Cm. (1–2′) wide, erect, entire, strap-shaped, smooth, shiny dark green; flowers 2–6, large, lilac-purple, resembling crocus except anthers extrorse; corolla-tube 12.5–15 Cm. (5–6′) long, two-thirds being underground; fruit of 3 inflated follicles, united at base, 4 Cm. ($1\frac{3}{5}'$) long, brown, papery, dehiscent; seeds numerous. Corm, ovoid, convex on one side, flattish with a groove on the other, 25 Mm. (1′) long, 18 Mm. ($\frac{3}{4}'$) thick; epidermis thin, brownish, wrinkled; internally whitish, solid; usually in reniform, transverse or ovate longitudinal slices, 2–5 Mm. ($\frac{1}{12}$–$\frac{1}{5}'$) thick; flat surfaces whitish, slightly roughened, crystalline under hand lens; fracture short, mealy; odor slight; taste bitter, acrid. POWDER, grayish-brown; microscopically—numerous starch grains, .003–.03 Mm. ($\frac{1}{8300}$–$\frac{1}{830}$′) broad, few tracheæ and fragments of epidermal cells. SEEDS, ovoid, irregularly globular, pointed at hilum, 2–3 Mm. ($\frac{1}{12}$–$\frac{1}{8}$′) broad, when fresh several seeds cohering, dark brown, finely pitted, tough, of almost bony hardness (by which they are distinguished readily from other seeds of similar appearance); internally whitish, mostly endosperm; nearly inodorous; taste bitter, acrid. POWDER, light brown; microscopically—oil globules, aleurone grains, starch grains, .005–.016 Mm. ($\frac{1}{5000}$–$\frac{1}{1550}$′) broad. *Solvents:* diluted alcohol; vinegar; wine. Dose, CORM, gr. 2–8 (.13–.5 Gm.); SEEDS, gr. 1–5 (.06–.3 Gm.).

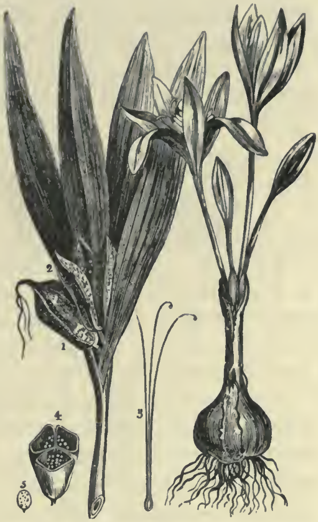


FIG. 45.—*Colchicum autumnale:* *1*, closed capsule; *2*, open capsule; *3*, styles; *4*, cross-section of capsule; *5*, seed.

Commercial. — Plant resembles our garden tulip, requiring 2 years for the cycle of complete development, but all parts have medicinal properties. Planting the bulb in the spring, by autumn a new cormus is formed on the lateral inferior portion, being still embraced half around by the parent whose place it is destined to take, sending roots downward and a spathe upward from which flowers emerge, Sept.–Oct., but as yet no leaves; the lower corolla-tube, underground, whitish, perishes by Nov., while the fruit rudiment (ovary) remains under-ground until the following spring, when it rises on the stem in the shape of a 3-lobed, 3-celled capsule, bringing with it the first leaves. The corm is most active when a year old, and should be collected June–August of the second year, after seeds are ripe and just before the sprouting forth of fall flowers from newly forming cormus; it is then most developed and least exhausted from the formation of new bud

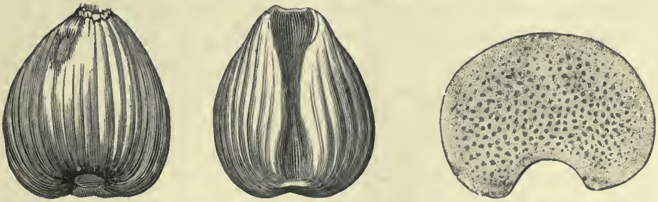


FIG. 46.—Colchicum corm (tuber): front and rear view; also transverse section.

and soon to be evolved corm, provided it be left in the ground. It now is dug, washed, sliced, and dried by sun or fire (65° C.; 150° F.), and resembles the tulip bulb, although without concentric scales; loses upon drying 70 p. c. The seeds are the most concentrated portion of the plant and should be collected when fully ripe, July–Aug.; their horny albumen renders powdering difficult, which is accomplished best in a mill with hardened plates; if pestle and mortar used, seeds must be absolutely dry or be macerated in their menstruum to soften, so as to mash easily. Unless very fine, cold solvents extract only one-third of the colchicine, but hot solvents exhaust irrespective of fineness. England and Germany furnish our supply, the quality usually being determined simply by the degree of bitterness.

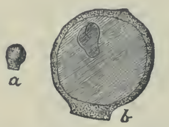


FIG. 47.—Colchicum seed: *a*, natural size; *b*, section magnified.

CONSTITUENTS.—Colchicine .5 p. c. (Colchiceine), Colchicoresin, Beta-colchicoresin, starch, sugar, fixed oil (seeds—5–6 p. c.), gum, ash 2.6–8 p. c.

Colchicina, Colchicine, $C_{22}H_{25}NO_6$, *official*. (Syn., Fr. Colchicine; Ger. Colchicin.)—This alkaloid is prepared by exhausting seeds with hot alcohol, recovering latter, adding water (to remove resin, fat, wax), shaking from brown filtrate with 4 portions chloroform, mixing these, distilling, dissolving residue in water, shaking with chloroform, evaporating last solution, thereby getting crude colchicine-chloroform; dissolve in alcohol, evaporate, treat with warm ether, crystallize, heat crystals with water, evaporate. It is in pale yellow, amorphous scales or powder, darker on exposure; odorless or nearly so; bitter taste; soluble in water (22), hot water (21), ether (220), benzene (100), alcohol, chloroform, insoluble in petroleum benzin; aqueous solution neutral, lævorotatory, yellowish, intensified by mineral acids; melts at 144° C. (291° F.). *Tests:* 1. Stir .001 Gm. with a few drops of sulphuric acid—lemon-yellow, changed by a drop of nitric acid to greenish-blue, red, yellow. 2. Aqueous solution (1 in 100) 5 Ml. (Cc.) + 2 drops of ferric chloride T. S.—no color (abs. of colchiceine); heat—brownish-red, then brownish-black. 3. Alcoholic solution (1 in 20) 1 Ml. (Cc.), + a drop of ferric chloride T. S. —garnet-red; incinerate .1 Gm.—ash non-weighable. 4. Heat .01 Gm. + potassium hydroxide T. S. 2 Ml. (Cc.) + a drop of aniline —no odor of phenyl-isocyanide (abs. of chloroform). This alkaloid and its salicylate are the best forms for use. Should be kept dark, in well-closed containers, and great caution must be used in tasting, and then only in very dilute solutions. Dose, gr. $\frac{1}{160}$–$\frac{1}{120}$ (.0004–.0005 Gm.).

Colchiceine, $C_{21}H_{23}NO_6+\frac{1}{2}H_2O$.—Not in drug, but produced as a result of hydrolysis in percolating with acid menstrua; readily converted into colchicine by etherification with methyl alcohol and hydrochloric acid, or with methyl iodide + sodium hydroxide in methyl alcohol; with mineral acids splits into acetic acid, methyl alcohol, and apocolchicine; it occurs in white crystals, non-toxic, inodorous, soluble in alcohol, chloroform, hot water, also in alkalies and their carbonates giving yellow solutions.

Colchicoresin, $C_{51}H_{60}N_2O_{15}$.—Brown, amorphous, soluble in chloroform, alcohol; insoluble in ether, sparingly in cold water.

Beta-colchicoresin, $C_{34}H_{39}NO_{10}$.—Blackish-brown, soluble in chloroform, strong alcohol; insoluble in water or ether. These last 2 are affected but slightly by tannin, are brownish-green by ferric chloride, and dissolve in potassium hydroxide with a brown color.

PREPARATIONS.—I. CORM: 1. *Extractum Colchici Cormi.* Extract of Colchicum Corm. (Syn., Ext. Colch. Corm., Powdered Extract of Colchicum Corm, Extractum Colchici Radicis, Acetic Extract of Colchicum; Br. Extractum Colchici; Fr. Extrait de Colchique (acétique); Ger. Zeitlosen Essigextrakt.)

Manufacture: Macerate, percolate 100 Gm. with alcohol until exhausted (200 Ml.; Cc.), reclaim alcohol until residue is 15 Ml. (Cc.), rinse still with a little warm alcohol, which add to residue in a flask, cool, shake thoroughly with purified petroleum benzin 25 Ml. (Cc.), again with 15 Ml. (Cc.), again with 10 Ml. (Cc.), discard benzin layers, transfer residue to dish, rinse flask with a little warm alcohol, which add to dish, evaporate to a thick extract, add dried starch 5 Gm., mix thoroughly, spread on glass plates, dry in air-bath at 70° C. (158° F.), pulverize; after assay add enough dried starch for extract to contain 1.4 p. c. of colchicine; mix thoroughly, pass through fine sieve; contains 1.25–1.55—1.4 p. c. of colchicine; 1 Gm. represents about 4 Gm. of the drug. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.).

II. SEEDS: 1. *Fluidextractum Colchici Seminis.* Fluidextract of Colchicum Seed. (Syn., Fldext. Colch. Sem., Fluid Extract of Colchicum Seed; Fr. Extrait fluide de Semence de Colchique; Ger. Zeitlosensamenfluidextrakt.)

Manufacture: Pack, percolate 100 Gm. with purified petroleum benzin until no greasy stain on filter paper, reject benzin solution; dry, air, repack, and proceed similar to Fluidextractum Sabal, page 95; menstruum: 67 p. c. alcohol; after dissolving soft extract in the reserve, assay and add enough menstruum for the 100 Ml. (Cc.) to contain .36–.44—.4 Gm. of colchicine. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

2. *Tinctura Colchici Seminis.* Tincture of Colchicum Seed. (Syn., Tr. Colch. Sem., Tinctura Colchici; Fr. Teinture (de Semences) de Colchique; Ger. Tinctura Colchici; Zeitlosentinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: 60 p. c. alcohol—percolate 95 Ml. (Cc.), assay, and add enough menstruum for the 100 Ml. (Cc.) to contain .036–.044—.04 Gm. of colchicine. Dose, ♏x–30 (.6–2 Ml. (Cc.)).

Unoff. Preps.: CORM: *Fluidextract,* dose, ♏ij–8 (.13–.5 Ml. (Cc.)). *Wine,* 40 p. c., dose, ♏v–15 (.3–1 Ml. (Cc.)). SEED: *Wine,* 10 p. c., dose, ♏x–30 (.6–2 Ml. (Cc.)).

PROPERTIES.—Alterative, cathartic, emetic, sedative, diuretic, diaphoretic, gastro-intestinal irritant: Small doses increase secretions generally (urine, sweat, etc.); normal doses produce only pains and loose bowels, having little or no effect on nervous system, circulation, respiration, or temperature.

USES.—Gout, rheumatism, especially if neuralgic, increases urea and uric acid elimination from blood, prurigo, urticaria, other gouty cutaneous troubles. Should be given with an alkali, pushing it just short of nausea, and before beginning with it the bowels should be moved with magnesium sulphate, oxide, or carbonate. Repeated attacks render larger doses necessary, and it may lose entirely its effect. Colchicum was used by the ancients in gout, etc., but falling into disfavor was revived by Störck as a diuretic, expectorant in dropsy, asthma. Again growing into odium, became reëstablished by Want, who thought it a component of *Eau médicinale d'Husson*, a celebrated gout cure.

Poisoning: Have persistent purging, tenesmus, nausea, vomiting, thirst, pain in throat, œsophagus, and stomach, suppressed urine, pinched face, dilated pupils, salivation, cold extremities, weak pulse, prostration, headache, delirium, spasms, stupor, death by gastro-enteritis or cardiac paralysis, conscious until the last. Evacuate stomach, if not already done, give tannin, morphine, demulcent drinks, stimulants, heat to extremities, hot abdominal fomentations, castor oil.

Incompatibles: Alcohol, opium (antagonizes cardiac depression), tannin, vegetable infusions.

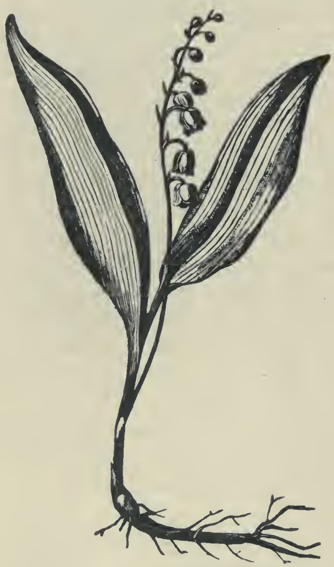


FIG. 48.—*Convallaria majalis.*

Synergists: Diuretics, purgatives, emetics, alkalies.

Allied Plants:

1. *Colchicum variega'tum, Oriental Hermodactyls.*—S. Europe, Asia Minor. Corm like official, but surface smooth, whitish to black, bitter, insipid.

2. *Convalla'ria maja'lis, Lily of the Valley.*—The dried rhizome and roots, official 1900–1910; flowers also used; United States; cultivated in gardens. Stemless perennial; leaves 2–3, radical, smooth, elliptical; flowers, campanulate, white, 1-sided raceme. Rhizome, variable length, 1–3 Mm. ($\frac{1}{25}$–$\frac{1}{8}$′) thick, internodes 5 Cm. (2′) long, cylindrical, brownish, few stem-scars at nodes above, thin roots or root-scars beneath; odor distinct; taste sweetish, bitter, acrid; solvents: diluted alcohol, boiling water partially; contains convallamarin, convallarin, resin. Heart tonic, diuretic, emetic, purgative, sternutatory, poisonous (similar to digitalis, but non-cumulative. *Poisoning:* Symptoms and treatment similar to digitalis. Dose, gr. 2–10 (.13–.6 Gm.); fluidextract (root—

75, flowers—67 p. c. alcohol); ♏ij–10 (.13–.6 Ml. (Cc.)); extract, or convallamarin, gr. ½–2 (.03–.13 Gm.); infusion, 25 p. c., ℥ss–1 (15–30 Ml. (Cc.)).

3. *Polygona'tum* (*Convallaria*) *multiflo'rum, European Solomon's Seal,* and *P. commuta'tum* (*gigante'um*), *American Solomon's Seal.* —Rhizome similar and contains convallarin, asparagin, mucilage, starch.

4. *Vag'nera* (*Smilaci'na*) *racemo'sa, False Solomon's Seal.*—N. America. *Tril'lium erec'tum, Beth* (*birth*) *root;* dried rhizome; uterine stimulant. Dose, gr. 15–30 (1–2 Gm.); fluidextract (75 p. c. alcohol).

11. SMILACEÆ. Smilax Family.

Smi-la'se-e. L. *Smil-ax* + aceæ, fr. Gr. σμίλη, a scraper—*i. e.*, alluding to the rough, prickly stems. Mostly vines, woody or herbaceous, stems often prickly. Distinguished by 3–5-nerved (net-veined) leaves, punctate; flowers 6's, umbels, anthers 2-celled, extrorse, ovary 3-celled; fruit globose-berry containing 1–6 brownish seeds; warm and temperate climates; alterative, diuretic, diaphoretic.

Genus: **1. Smilax.**

SARSAPARILLA. SARSAPARILLA.

Smilax { **medica,** *Chamisso et Schlechtendal,*
officinalis, *Kunth,*
ornata, *Hooker filius.* } The dried root.

Habitat. Tropical America, Mexico to Brazil; Andes and Chinqui Mountains, 1,200–2,400 M. (4,000–8,000°) elevation; swampy forests.

Syn. Sarsap., 1. Mexican, Vera Cruz, Tampico Sarsaparilla; 2. Honduras, Bearded, Red Sarsaparilla; 3. Jamaica, C. America, Costa Rica, Lima Sarsaparilla; Sarsæ Radix; Fr. Salsepareille du Mexique; Ger. Radix Sarsaparillæ, Sarsaparille.

Smi'lax. L. Bindweed, Gr. σμῖλαξ, the yew, fr. σμίλη (Eng. smile), a scraper—*i. e.*, stems rough with prickles.

Med'i-ca. L. *medicus*, medical, curative—*i. e.*, its healing properties.

Of-fi-ci-na'lis. L. see etymology of (*Asagræa*) *officinalis*, page 102.

Or-na'ta. L. *ornatus*, fr. *ornare*, to adorn—adorned, decorated, ornamented —*i. e.*, beautiful fruit and foliage.

Sar-sa-pa-ril'la. L. fr. Sp. *zarzaparilla*—*zarza*, a bramble, + *parra*, a vine, or from *Parillo*, a physician said to have discovered and employed it.

PLANTS.—Large perennial, thorny climbers; rhizomes short, thick, knotted, nodes thick, from which spring purplish-white roots 2–2.5 M. (6–8°) long, and a few rootlets; stems many, stiff, woody, angular, ridged, subterete or quadrangular, prickles at nodes; leaves 10–30 Cm. (4–12′) long, 7.5–15 Cm. (3–6′) wide, petioles 5 Cm. (2′) long, quadrangular, cordate, rounded lobes at base, entire, glabrous, leathery, dark glossy green; flowers diœcious, 10–20 together in umbels; fruit small berry, 8 Mm. (⅓′) thick, red, 2–3-seeded. ROOT (*S. medica*): *Mexican*, in loose bundles, or pressed bales, single bundles, 30–60 Cm. (12–24′) long, composed of 20–35 folded roots attached to a crown with one or more stout stems; roots 3.5–6 Mm. (⅐–¼′) thick, grayish-brown, dark brown, minutely hairy, longitudinal furrows with blackish earth; fracture tough, fibrous; internally light brown with shrunken, mealy or horny cortex surrounding the porous central cylinder, pith distinct, nearly inodorous, taste mucilaginous, sweetish, acrid; (*S. officinalis*)*: Honduras,* in compact, cylindrical bundles, 30–55 Cm. (12–22′) long, 8–15 Cm. (3–6′) thick, composed of long, folded roots bound together by a number of circular turns; roots 2–6 Mm. ($\frac{1}{12}$–$\frac{1}{4}$′) thick; dark-, reddish-brown, longitudinal furrows usually without earth; fracture fibrous; internally grayish-white, dark brown cortex, light yellow, porous central cylinder, whitish pith, taste mucilaginous, slightly acrid; (*S. ornata*)*: Jamaica,* in more or less compact, somewhat flattened bundles, 30–45 Cm. (12–18′) long, 10–15 Cm. (4–6′) broad, composed of folded roots loosely bound together by a few circular turns; roots 2–5 Mm. ($\frac{1}{12}$–$\frac{1}{5}$′) thick, grayish-, reddish-brown, longitudinally wrinkled, more or less furrowed, bearing many coarse fibrous rootlets; taste sweetish, slightly bitter. POWDER, grayish-brown; microscopically—numerous starch grains, .003–.023 Mm. ($\frac{1}{8300}$–$\frac{1}{1075}$′) broad, raphides of calcium oxalate, singly or in groups, hypodermal and endodermal cells with yellowish, reddish walls

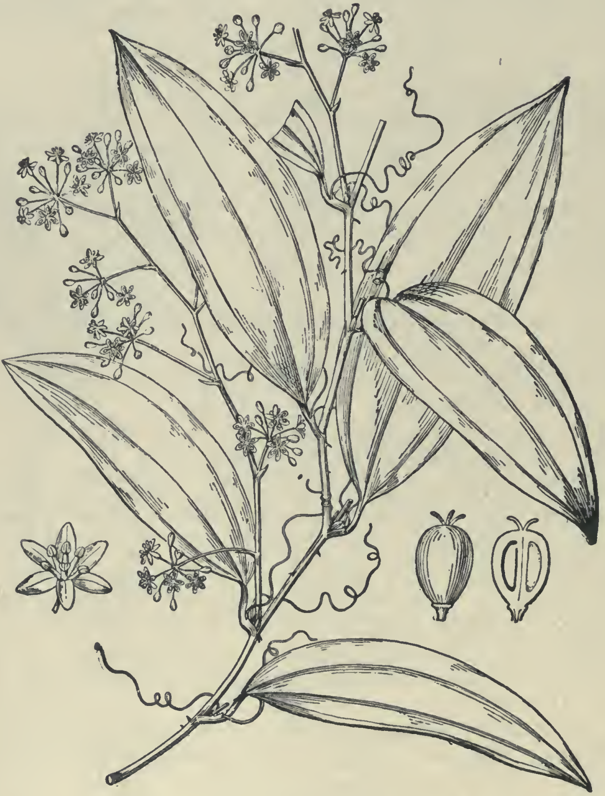


FIG. 49.—Smilax: branch with flowers and fruit.

—Mexican with irregular thickening; fragments of tracheæ, sclerenchymatous fibres with porous walls; the woody knotty crown with portions of overground stems should be removed. *Solvents:* diluted alcohol; boiling water, injured by continued boiling. Dose, ʒss–2 (2–8 Gm.).

Commercial.—Sarsaparilla was carried to Europe from Peru, St. Domingo, Brazil, by the Spaniards in 1550, and has been in general use ever since. Plants occur in very thick undergrowth that renders careful collection quite troublesome, which is effected by grubbing, pulling, etc., so as to avoid extermination; those fully grown often yield at first cutting 30–60 pounds (13.6–27 Kg.), and every 2 years thereafter smaller quantities of more slender, less starchy roots. Collectors accept as best that having many roots from stem, persistent acrid taste, closely set prickles and thin leaves, and according to physical properties recognize two kinds (*a*) *Non-mealy:* Mexican, Jamaica, thin, not cracked, red, brown, little or no starch, usually pasty, rarely in granules, somewhat horny with longitudinal and irregular folds; thought best as roots have more rootlets, greater acridity, and yield most extract, dissolving clearly in cold water; (*b*) *Mealy:* Honduras, Para, more or less swollen, pale yellow, transversely cracked, considerable starch, usually in fine granules, seldom pasty. There are four varieties: 1, *Mexican,* once thought valueless, but now, owing to acridity, most valuable; grows in Mexican Andes, around Orizaba, Vera Cruz, etc., being considered a variety of *S. officinalis,* with slender branches, and often without prickles; 2, *Jamaica,* grown chiefly in Costa Rica, some in the Amazon Valley, and called "Jamaica" as it is exported through that province; resembles Honduras, but redder, less wrinkled and amylaceous, and yields more extract; 3, *Honduras,* most popular, grown in Honduras, Guatemala, Peru, Colombia, C. America; enters market in bales, skins, 100 pounds

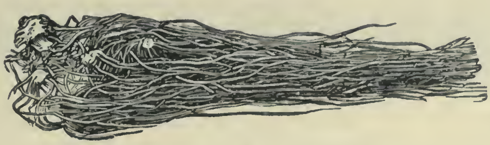


FIG. 50.—Mexican sarsaparilla.

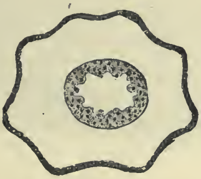


FIG. 51.—Mexican sarsaparilla: cross-section: magnified 3 diam.

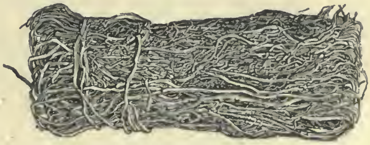


FIG. 52.—Jamaica sarsaparilla.

(45.3 Kg.); 4, *Para* (*Brazillian, Rio Negro, Lisbon—S. papyra'cea*), in compact cylindrical bundles, 30–90 Cm. (12–36′) long, 15–20 Cm. (6–8′) thick, closely and neatly bound, by a stem of a vine, and ends evenly trimmed; rootlets few, dark, amylaceous, acrid, resembling Honduras, and growing in N. Brazil, Guiana (Para, Maranham); considered a variety of *S. officinalis*, with older stems and lower branches remaining square, angles with flattened prickles and much more membraneous leaves; rather rare, and the only one of the four varieties not recognized in U. S. P.

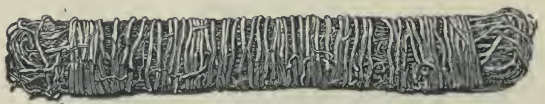


FIG. 53.—Honduras sarsaparilla.

The *Guayaquil* (*S. officinalis*), growing in W. Andes valleys, occasionally enters market, usually loose and carelessly packed in bales, rhizome and stem portions often included; roots dark with much fibre, bark furrowed, thick, somewhat amylaceous, internally pale yellow. Roots are taken also from *S. syphilit'ica* (Colombia), *S. glau'ca* (Mexico), *S. util'is* (Jamaica), etc.

CONSTITUENTS.—Saponin-like substance (separable into 3 glucosides—Sarsasaponin, Parillin, Smilasaponin) 3 p. c., volatile oil, resin, starch 10–15 p. c., pectin, coloring matter, calcium oxalate and other salts, ash 7–10 p. c.

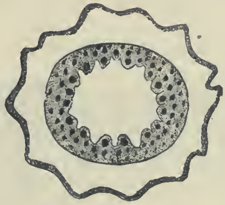


FIG. 54.—Honduras sarsaparilla: cross-section; magnified 3 diam.

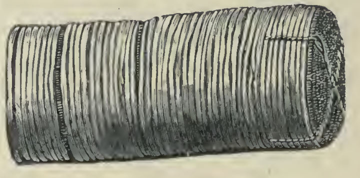


FIG. 55.—Para sarsaparilla.

Sarsasaponin, $C_{22}H_{36}O_{10}$, is the most important component, being 3–4 times more active than the other two; it is crystallizable, soluble in water, alcohol, more so with heat.

Parillin (**Smilacin**), $C_{26}H_{44}O_{10}$, crystallizable, soluble in water, alcohol, frothing with agitation, aqueous solution precipitated by lead acetates, tannin; boiled with diluted acids splits into sugar and parigenin.

Smilasaponin, $C_{20}H_{32}O_{10}$, non-crystallizable, soluble in water, alcohol.

PREPARATIONS.—1. *Fluidextractum Sarsaparillæ.* Fluidextract of Sarsaparilla. (Syn., Fldext. Sarsap., Fluid Extract of Sarsaparilla;

Extractum Sarsæ Liquidum; Fr. Extrait fluide de Salsepareille; Ger. Sarsaparillafluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: diluted alcohol. Dose, ʒss–1 (2–4 Ml. (Cc.)).

Prep. 1. *Syrupus Sarsaparillæ Compositus.* Compound Syrup of Sarsaparilla. (Syn., Syr. Sarsap. Co., Syrupus Sudorificus; Fr. Sirop de Salsepareille composé, Sirop sudorifique; Ger. Zusammengesetzter Sarsaparillsirup.)

Manufacture: Fluidextract of sarsaparilla 20 Ml. (Cc.), fluidextract of glycyrrhiza 1.5 Ml. (Cc.), fluidextract of senna 1.5 Ml. (Cc.), syrup 75 Ml. (Cc.), oil of sassafras .02 Ml. (Cc.), oil of anise .02 Ml. (Cc.), methyl salicylate .02 Ml. (Cc.), alcohol (1.94) q. s. 100 Ml. (Cc.). Dose, ʒj–4 (4–15 Ml. (Cc.)).

2. *Fluidextractum Sarsaparillæ Compositum.* Compound Fluidextract of Sarsaparilla. (Syn., Fldext. Sarsap. Co., Compound Fluid Extract of Sarsaparilla; Fr. Extrait fluide de Salsepareille composé; Ger. Zusammengesetztes Sarsaparillafluidextrakt.)

Manufacture: Sarsaparilla 75 Gm., glycyrrhiza 12 Gm., sassafras 10 Gm., mezereum 3 Gm.; similar to Fluidextractum Ergotæ, page 60; 1st menstruum: alcohol 50 Ml. (Cc.), water 40, glycerin 10; 2nd menstruum: diluted alcohol. Dose, ʒss–1 (2–4 Ml. (Cc.)).

Unoff. Preps.: Compound Decoction 10 p. c. (+ sassafras 2, guaiacum wood 2, glycyrrhiza 2, mezereum 1), dose, ℥j–4 (30–120 Ml. (Cc.)). *Decoction. Extract,* dose, gr. 5–10 (.3–.6 Gm.). *Extract Comp. Syrup.*

Properties.—Alterative, diuretic, diaphoretic, tonic. Mostly believed to be of little service unless associated with other drugs, such as potassium iodide, guaiac, sassafras, mezereum, etc.

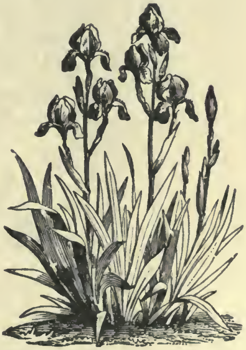


Fig. 56.—Iris in bloom.

Uses.—As a blood purifier in scrofula, cutaneous diseases, abscesses, ulcers, tertiary syphilis with mercuric chloride or potassium iodide or both; gout, rheumatism.

Incompatibles: Alkalies, iodine, and corrosive sublimate is claimed to be converted into calomel by the compound syrup.

Allied Plants:

1. *Smilax chi'na, S. pseu'do-chi'na, S. tamnoi'des, S. as'pera,* and *Ca'rex arena'ria, German Sarsaparilla.*—All used like official.

2. *Dioscore'a villo'sa.* Dried rhizome; diaphoretic—rheumatism, dose, ʒss–1 (2–4 Gm.), fluidextract (80 p. c. alcohol).

3. *I'ris versic'olor, Blue Flag.* — Iridaceæ. The rhizome and roots official 1820–1900; N. America (swampy places). Perennial herb, .6–1 M. (2–3°) high; stem angled on one side, branched, bearing 2–6 beautiful, purplish-blue flowers; leaves long, sword-shaped. Rhizome, 5–10 Cm. (2–4′) long, jointed, annulated, 20 Mm. ($\frac{4}{5}$′) broad, sub-cylindrical, grayish-brown; odor slight; taste acrid, nauseous; contains extract (resin) 25 p. c.—volatile oil

.025 p. c., isophthalic acid, sugar, phytosterol, myricyl alcohol, heptatosane, ipuranol, cerotic acid. Cholagogue cathartic, emetic, diuretic, alterative; costiveness, malarial jaundice, bilious remittent fever, dropsy, but is very nauseating and prostrating; less irritating than podophyllum, more purgative than euonymus. Dose, gr. 5–20 (.3–1.3 Gm.); extract, gr. 1–4 (.06–.26 Gm.); fluidextract (alcohol), ♏v–20 (.3–1.3 Ml. (Cc.)); irisin or iridin ("Eclectic" oleoresin or resinoid) gr. 1–4 (.06–.26 Gm.).

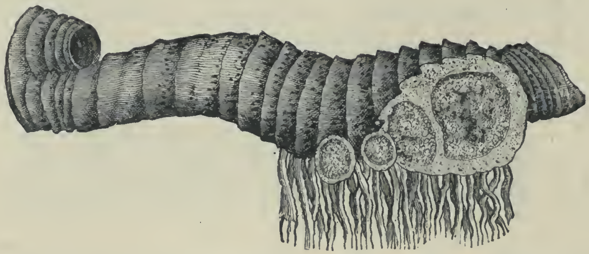


Fig. 57.—*Iris versicolor:* joint of rhizome and section of branches.

4. *I. florenti'na, Florentine Orris* (*White Flag*).—The rhizome, official 1820–1880; N. Italy (near Florence), Germany, France. Perennial plant, leaves radical, sword-shape, shorter than stem, which rises in their midst (.3–.6 M.; 1–2°) high, bearing 2 large white or bluish flowers; fruit capsule, 3-celled, many-seeded; rhizome 5–10 Cm. (2–4′) long, 12–18 Mm. ($\frac{1}{2}$–$\frac{3}{4}$′) thick, flattish, peeled, whitish, on upper side fibro-vascular bundles, below many brownish scars of roots, fracture short; odor violet-like; taste mealy, bitter, acrid; contains

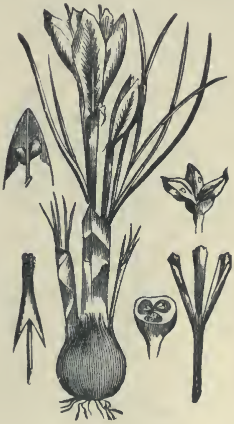


Fig. 58.—*Crocus sativus.*

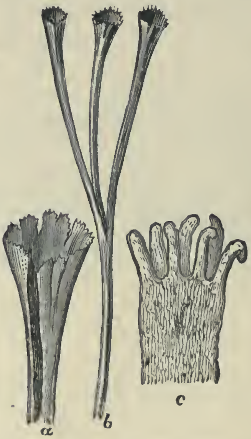


Fig. 59.—Crocus; *a*, stigma, upper part magnified 4 diam.; *b*, style with stigmas; *c*, papillose margin of stigma, magnified 120 diam.

volatile oil, starch, resin, tannin. Used as stimulant, diuretic, emetic, cathartic; fresh root irritant, for diarrhœa, bronchitis, dropsy, masticatory for perfuming breath and teething infants; for this latter the more slender pieces are peeled smoothly and whitened with chalk or magnesium oxide. This is adulterated with the rhizomes of *I. pal'lida, I. german'ica, I. pseudac'orus, I. fœtidis'sima,* all of which are somewhat darker, more astringent and acrid.

5. *Cro'cus sati'vus, Saffron.*—Iridaceæ. The stigmas, official 1820–1900; W. Asia, Spain, France. Perennial herb with solid, depressed-globular corm (bulb), 2.5 Cm. (1′) thick; flowers lilac, bluish-purple. Stigmas, 3-cleft, convolute, orange-red, 3 Cm. ($1\frac{1}{5}$′) long, tubular, notched above, odor peculiar, aromatic, bitter; contains picrocrocin (yielding by hydrolysis volatile oil and fructose), crocin (impure—amorphous), fixed oil, ash 5–8 p. c. Largely adulterated with florets, dyed stamens, petals, mineral matter (sodium bicarbonate, biborate, sulphate, potassium nitrate, Rochelle salt, milk-sugar, etc.), increasing ash to 17–32 p. c. There are three varieties: 1, Austrian (best); 2, French (Gatinais); 3, Spanish (inferior from presence of style bases and stigmas); known as *hay saffron,* as distinguished from *cake saffron,* which is no longer in commerce. Diaphoretic, carminative, emmenagogue, anodyne; to promote exanthematous eruptions in measles, etc., dysmenorrhœa, conjunctivitis. Dose, gr. 5–30 (.3–2 Gm.); infusion (tea), 2 p. c., ℥ij–4 (60–120 Ml. (Cc.)); tincture, 10 p. c. (diluted alcohol), ʒj–2 (4–8 Ml. (Cc.)).

12. ZINGIBERACEÆ. Ginger Family.

Zin-ji-be-ra'se-e. L. *Zingiber* + aceæ, fr. Gr. ζιγγίβερις, ginger. Herbs. Distinguished by being aromatic, with creeping rhizomes; leaves stalked, broad, sheathing, parallel veins from midrib. Perianth superior, irregular. Each whorl 3, stamens 6, in 2 whorls, outer whorl staminodial or absent; ovary 3-celled, inferior; fruit 1–3-celled, capsule or berry; seeds many, arillate; tropics; stimulant; aromatic, stomachic (resin + vol. oil), starch, food.

Genera: **1. Elettaria. 2. Zingiber.**

CARDAMOMI SEMEN. CARDAMOM SEED.

Elettaria Cardamomum, *White et Maton.* { The dried seeds, recently removed from the capsules.

Habitat. Malabar, cultivated. India, Mountains, 750–1,500 M. (2,500–5,000°) elevation; Ceylon, Annam, Siam.

Syn. Cardam. Sem., Cardamomum, U. S. P. 1900, Malabar, Ceylon or Bastard Cardamom; Br. Cardamomi Semina, Cardamom Seeds, Cardamomum (Minus) Malabari (am)-cum; Fr. Cardamomes, Petit Cardamome; Ger. Fructus (Semen) Cardamomi (Minoris), Malabar-(Malabarische) Kardamomen, Kleine Kardamomen.

El-et-ta'ri-a. L. fr. *Elettari—i. e.,* native name of plant in Malabar.

Car-da-mo'mum. L. fr. Gr. κάρδος, thistle, + ἄμωμος, blameless, classic name.

Plant.—Perennial herb; stems green, 2–4 M. (6–12°) high, tapering, shining, covered with leaf-sheaths; leaves .3–.8 M. (1–2½°) long, 2.5–12.5 Cm. (1–5′) broad, lanceolate, flower stalk from stem base lies on the ground; flowers, in rainy season, Jan.–May, greenish-white; rhizome tuberous, woody, fibrous roots below, scars above;

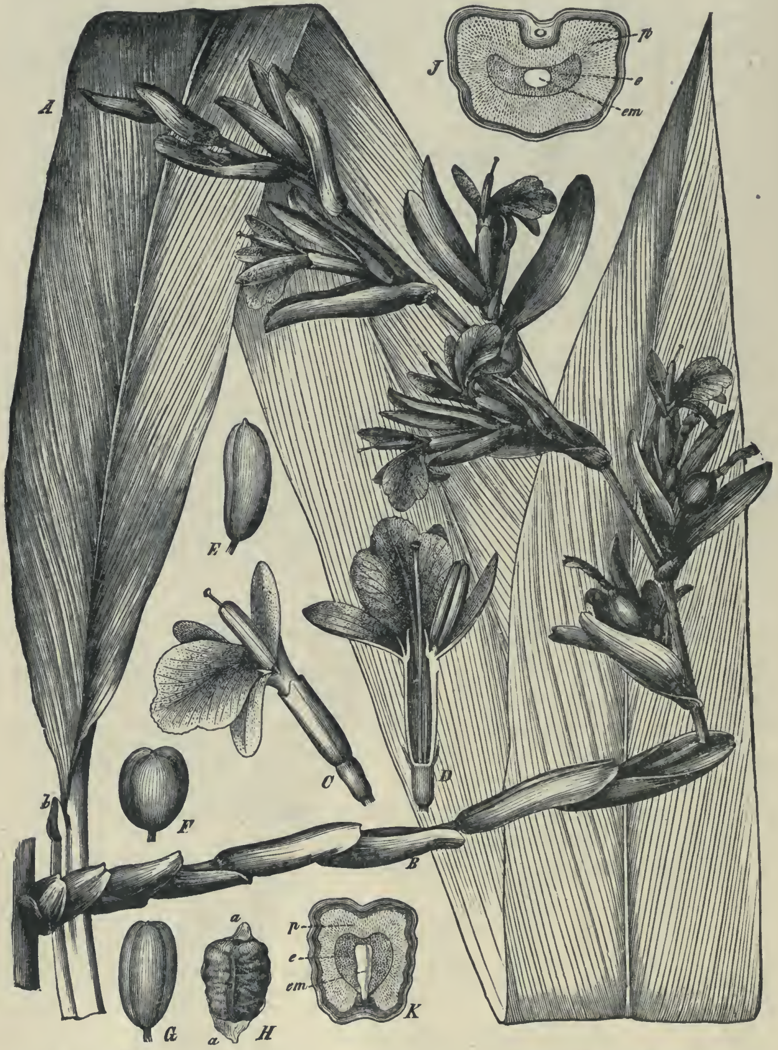


Fig. 60.—*Elettaria Cardamomum: A*, leaf with ligule, *b; B*, bracts; *C*, flower, natural size; *D*, flower with calyx and corolla-tube partially removed; *F*, *G*, capsule form; *H*, seed with arillus, *a; J*, cross-section of seed 8 times enlarged; *K*, longitudinal section 5 times enlarged; *p*, perisperm; *em*, embryo; *e*, endosperm.

fruit capsule, ellipsoidal, triangular, 10–20 Mm. ($\frac{2}{5}$–$\frac{4}{5}$′) long, 6 Mm. ($\frac{1}{4}$′) broad, pale buff, striate, 3-locular, pericarp thin, leathery, nearly tasteless. SEEDS, 10–20, oblong-ovoid, 3–4-sided, dorsal surface convex, 3–4 Mm. ($\frac{1}{8}$–$\frac{1}{6}$′) long, one side longitudinally grooved, reddish-gray-brown, coarsely tuberculated, portions of membranous aril adhering; section—thin reddish-brown seed-coat, large white perisperm, central greenish endosperm enclosing small embryo; mostly agglutinated in groups of 2–7; odor aromatic; taste aromatic, pungent. POWDER, greenish-brown; microscopically—angular fragments of cells of reserve layers and seed-coat, endosperm and perisperm cells filled with starch grains, .001–.004 Mm. ($\frac{1}{25000}$–$\frac{1}{6250}$′) broad, stone cells, rosette aggregates, spiral tracheæ, lignified bast-fibres. Seeds constitute 75 p. c. of the fruit, keep best in the pericarp, from which they should only be removed just prior to using. *Solvents:* diluted alcohol; boiling water. Dose, gr. 5–15 (.3–1 Gm.).

ADULTERATIONS.—SEEDS: Rare—those of various varieties and allied species taken from the pericarp; ENTIRE FRUIT—with orange seeds, green coffee, etc.; POWDER: Starch, sodium carbonate, ginger (recognized by its larger starch grains), etc.

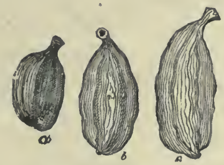


FIG. 61.—Malabar cardamom: *a*, short; *b*, medium; *c*, long.

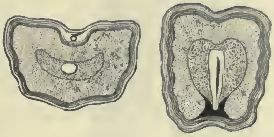


FIG. 62.—Cardamom seed: transverse and longitudinal section, magnified 5 diam.

Commercial.—Plant grows wild but mostly by cultivation in Malabar (W. Mysore) and Ceylon, on spaces cleared in mountain forests affording shade, or on betel-nut plantations, and yields the fourth year and many thereafter. Fruit is gathered mostly in dry weather, Oct.–Dec., preferably prior to maturity to minimize splitting, then dried artificially on tiers of trays in curing houses (brownish), or better in the sun, guarding against rain and excessive heat exposure, that cause the moist seeds to swell and rupture pericarp (yellowish); the slower the drying, the less the splitting. Bleaching is effected by exposing to sulphur fumes, or to dew and sunlight, the finest by washing with alternating solutions of lathery soap-berry and astringent acacia pods, finally drying in the sun. Value is determined by size, color, plumpness, smoothness (the best being creamy white, smooth, silky) and are assorted through sieves into 4 kinds: (*a*) *Shorts*, 12 Mm. ($\frac{1}{2}$′) long, 6 Mm. ($\frac{1}{4}$′) broad, plump, heavy; (*b*) *Mediums*, 18–25 Mm. ($\frac{3}{4}$–1′) long, 6 Mm. ($\frac{1}{4}$′) broad, paler buff, finer ribbed; (*c*) *Longs*, 25–31 Mm. (1–1$\frac{1}{4}$′) long, 4 Mm. ($\frac{1}{6}$′) broad, rarely imported; (*d*) *Tiny*, least desirable. There are several varieties: 1, *Mysore* (*Ceylon-Mysore, Alleppi*), shorts, best, bleached and unbleached (greenish), exported from Alleppi, Calicut; 2, *Malabar*, shorts, mediums, high grade, preferred by some, exported from Ceylon, India (Bombay), brown, striated; 3, *Madras,* usually mediums, pale buff, exported from Madras, Pondicherry; 4, *Mangalore;* 5, *Ceylon Mangalores,* round, valuable. The *Ceylons* are the wild-grown fruits of Ceylon, and the *Siam* of Cochin, Annam, Tonquin (Tonking) combined; the shorts of all varieties are best and most desired; imported in chests, 60–100–200 pounds (27–46–91 Kg.). The shelled seeds, owing to rapid deterioration, should not be a commercial article.

Constituents.—Volatile oil 5 p. c., fixed oil 10 p. c., potassium salts 2.5 p. c., starch 3 p. c., nitrogenous mucilage 1.8 p. c., yellow coloring matter .4 p. c., ligneous fibre 77.3 p. c., manganese .8 p. c., ash 6–8–15 p. c.

Volatile Oil (*oleum cardamomi*).—Mostly in the testa; has odor and taste of the drug, somewhat camphoraceous, sp. gr. 0.900; contains terpinene, $C_{10}H_{16}$, possibly dipentene, a body of the composition $C_{10}H_{18}O$ (terpineol?), and acetic and formic acids. It is obtained by distillation or extraction with ether. The latter method gives more durable oil, but one mixed with fixed oil, it being soluble also in ether; this latter, however, may readily be separated. The distilled oil easily deteriorates by age.

Preparations. — 1. *Tinctura Cardamomi.* Tincture of Cardamom. (Syn., Tr. Cardam.; Fr. Teinture de Cardamome; Ger. Kardamomentinktur.)

Manufacture: 15 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: diluted alcohol. Dose, ʒj–2 (4–8 Ml. (Cc.)).

2. *Tinctura Cardamomi Composita.* Compound Tincture of Cardamom. (Syn., Tr. Cardam. Co.; Fr. Teinture de Cardamome composée; Ger. Zusammengesetzte Kardamomentinktur.)

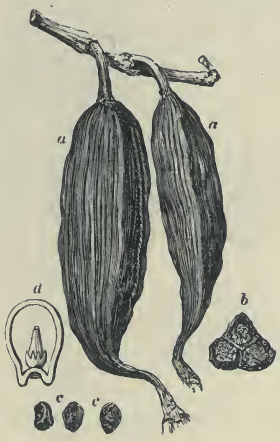


Fig. 63.—Ceylon cardamom: *a*, capsules; *b*, transverse section of capsule; *c*, seeds; *d*, section of seed with embryo; magnified.

Manufacture: 2 p. c. Similar to Tinctura Aloes, page 110—using cardamom seed 2 Gm., saigon cinnamon 2.5 Gm., caraway 1.2 Gm., cochineal .5 Gm., macerating with 75 Ml. (Cc.) of a mixture of glycerin 5 Ml. (Cc.), diluted alcohol 95 Ml. (Cc.), finishing with diluted alcohol q. s. 100 Ml. (Cc.). Dose ʒj–2 (4–8 Ml. (Cc.)).

3. *Extractum Colocynthidis Compositum,* 5 p. c. 4. *Pulvis Aromaticus,* 15 p. c. 5. *Tinctura Gentianæ Composita,* 1 p. c. 6. *Tinctura Rhei,* 3 p. c.

Unoff. Preps.: Compound Elixir. Fluidextract. Infusion, dose, ℥j–2 (30–60 Ml. (Cc.)). *Compound Infusion. Compound Spirit,* 10 p. c. (vol. oil), +.

Properties.—Carminative, stomachic, stimulant, aromatic, condiment.

USES.—Adjuvant or corrective to cordials, tonics, purgatives, flavoring liquors, cakes, breath, etc.

Allied Plants:

1. *Elettaria ma'jor, Ceylon Cardamom.*—About 40 Mm. (1$\frac{3}{5}$′) long, triangular, prolonged into a beak 15 Mm. ($\frac{3}{5}$′) long, brownish-gray color.

2. *Amo'mum Cardamo'mum, A. ve'rum* and *A. globo'sum, Round Cardamom.*—Siam, Java, China, globular-ovate. *A. aromat'icum, Bengal Cardamom,* 9-winged at apex. *A. xanthoi'des, Wild* or *Bastard Cardamom, A. max'imum, Java Winged Cardamom,* 9–12-winged from base to apex, and *A. Gra'num-paradi'si, Grain of Paradise.* Fruit resembles cardamom seeds, several varieties, used for ginger.

3. *Maran'ta arundina'cea, Arrow-root.*—The fecula of the rhizome, official 1820–1880; W. Indies, Bermudas, Brazil. Plant slender, 1–2 M. (3–6°) high, leaves 7.5–12.5 Cm. (3–5′) long, lanceolate, flowers white, rhizome perennial, tuberous, fleshy, scaly, 15–30 Cm. (6–12′) long. Arrow-root in powder or lumps 4 Mm. ($\frac{1}{6}$′) thick, white, opaque; under microscope consists of oval granules of fine-lined layers, nucleus at broad end. The rhizome when 1–2 years old is dug, washed, deprived of scales, ground under water, kneaded, strained, and the fecula allowed to subside; fresh rhizome yields starch 13–20 p. c.; root contains starch 27 p. c., fat .2 p. c. Used as demulcent, nutritive food for infants, convalescents, bowel or urinary troubles; in 5 p. c. solution with water or milk by boiling and flavoring with vanilla, lemon juice, etc.; also used in puddings. The jelly is more tenacious than that of all other starches, except Canna.

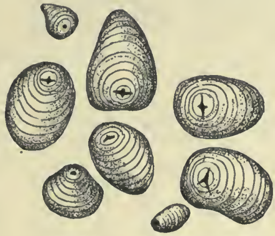


FIG. 64.—Maranta starch.

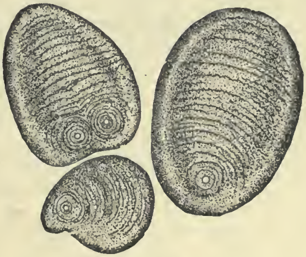


FIG. 65.—Canna starch.

4. *Can'na ed'ulis, Canna (Tous-les-mois).*—The fecula of rhizome, official 1870–1880; Peru, Brazil. Perennial herb 2.5 M. (8°) high; stem green; leaves parallel-veined, bluish-green; flowers few, in pairs, red; yellow, purple, bract; fruit round capsule, 12 Mm. ($\frac{1}{2}$′) thick; rhizome creeping, fleshy, thick joints. Canna starch white powder, satiny; under microscope granules largest of all, potato coming next, $\frac{1}{12}$–$\frac{1}{8}$ Mm. ($\frac{1}{300}$–$\frac{1}{200}$′) long, flat, ovate, hilum at narrow end, encircled by many unequally distant rings. Grind rhizome under water, knead, strain, allow to subside. Used as demulcent, nutritive food for urinary and bowel affections, infants, invalids in convalescence.

RECAPITULATION No. 1.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
Gigartinaceæ: 1. Chondrus. 2. Chondrus.	Chondrus crispus, Gigartina mamillosa.	The dried plants.	N. Atlantic Ocean.	Mucilage, minerals, albuminoids.	....	Demulcent, nutritive, dietetic.	Bronchitis, diarrhœa, kidney and bladder trouble, scrofula.	Grains. 60–120 (4–8 Gm.).
Hypocreaceæ: 1. Ergota. 2. Ergot.	Claviceps purpurea.	The sclerotium.	Russia, Spain.	Ergotoxine, parahydroxyphenylethylamine, isoamylamine, ergamine, enzymes, fixed oil, scleromucin.	Fluidextr., extract.	Emmenagogue, ecbolic, hæmostatic, excitomotor, poisonous.	In labor, dysmenorrhœa, polypi, amenorrhœa, hemorrhages, hemorrhoids.	15–60 (1–4 Gm.).
Polypodiaceæ: 1. Aspidium. 2. Aspidium.	Dryopteris: Filix-mas, marginalis.	The rhizome and stipes.	N. America, N. Asia, Europe.	Filicic acid, filicin, fixed oil, filitannic acid, vol. oil, resin.	Oleoresin.	Tænifuge.	Tape-worms.	30–120 (2–8 Gm.).
Lycopodiaceæ: 1. Lycopodium. 2. Lycopodium.	Lycopodium clavatum.	The spores.	Europe, Asia, N. America.	Fixed oil, cane-sugar, volatile base (methylamine).	....	Diuretic, antispasmodic for rheumatism, epilepsy, pulmonary, renal disorders.	Externally for erysipelas, eczema, herpes, ulcers, chafing, to prevent adherency of pills and suppositories.	Externally.
Pinaceæ (Coniferæ): 1. Oleum Terebinthinæ. 2. Oil of Turpentine.	Pinus palustris +.	Volatile oil.	N. America.	Pinene, $C_{10}H_{16}$.	*Oil:* Recti. oil, liniment, terebene, terpin hydrate, emul., canthar. cerate. *Rosin:* ros. cer., ros. plaster, cer. canth., tar.	Stimulant, carminative, cathartic, anthelmintic, hæmostatic, expectorant, antiseptic, diuretic, rubefacient.	Bronchitis, catarrh, cystitis, gleet, urinary troubles, piles, hemorrhages, erysipelas, worms, pneumonia, rheumatism, renal colic, sprains, scabies.	Minims. 5–30 (.3–2 Ml. (Cc.)).
1. Resina. 2. Rosin.	....	Resin.	....	Abietic, pinic and sylvic acids.				
1. Oleum Pini Pumilionis. 2. Oil of Dwarf Pine Needles.	Pinus montana.	Volatile oil.	C. Europe.	Pinene, phellandrene, sylvestrene.	....	Antirheumatic, expectorant, stimulant, antiseptic.	Rheumatism, bronchitis, laryngitis.	1–5 (.06–.3 Ml. (Cc.)).
1. Oleum Juniperi. 2. Oil of Juniper.	Juniperus communis.	Volatile oil.	N. America.	Pinene, $C_{10}H_{16}$, cadinene, $C_{15}H_{24}$.	Spirit, comp. spt.	Stimulant, diuretic, anodyne, antiseptic, emmenagogue, carminative.	Renal dropsy, urinary catarrh, rheumatism, swellings.	5–15 (.3–1 Ml. (Cc.)).
1. Oleum Cadinum. 2. Oil of Cade.	Juniperus Oxycedrus.	Volatile oil.	S. Europe.	Phenols, cadinene, $C_{15}H_{24}$.	....		Psoriasis, pityriasis rubra, eczema.	3–5 (.2–.3 Ml. (Cc.)).
Graminaceæ: 1. Amylum. 2. Starch.	Zea Mays.	The starch grains from fruit.	....	$(C_6H_{10}O_5)_3$	Glycerite, diluent in extracts, etc.	Nutritive, demulcent.	Allays itching, urticaria, erysipelas, inflamed rectum, bladder, protective.	Grains. 30–120 (2–8 Gm.).

1. Saccharum. 2. Sugar.	Saccharum officinarum, Beta vulgaris, var. Rapa.	The juice evaporated and crystallized.	S. Asia.	$C_{12}H_{22}O_{11}$.	Syrup, many troches and medicated syrups, pills, powders, etc.	Demulcent, lenitive, laxative, ulcerations.	Vehicle, corrigent, preservative, antiseptic, excipient, coughs, hiccough, ascarides, ulcers, wounds, eye troubles.	Ad libitum.
1. Triticum. 2. Triticum.	Agropyron repens.	The dried rhizome.	Europe, N. America.	Triticin, fruit-sugar, inosite, glucose, malates, lactic acid.	Fluidextract.	Diuretic, aperient, demulcent.	Cystitis, gravel, jaundice, bronchitis, gout, skin troubles, fevers.	30–180 (2–12 Gm.).
1. Maltum. 2. Malt.	Hordeum sativum.	The partially germinated grain dried.	W. Asia, China.	Diastase, peptose, dextrose, sugar, starch.	Extract.	Nutritive, laxative demulcent.	Dyspepsia, phthisis, wasting diseases, emulsifying agent.	Ad libitum.
Palmaceæ:								
1. Sabal. 2. Sabal.	Serenoa serrulata.	The partially dried ripe fruit.	S. United States.	Volatile oil, fixed oil, fat, alkaloid, resin.	....	Sedative, diuretic, expectorant, tonic.	Bronchitis, phthisis, whooping-cough, prostate gland, asthma.	15–60 (1–4 Gm.).
Melanthaceæ:								
1. Veratrum Viride. 2. Veratrum Viride.	Veratrum viride.	The dried rhizome and roots.	N. America.	Protoveratrine, jervine, rubijervine, pseudojervine, cevadine, resin—veratroidine.	Fluidextract, tincture.	Sedative, emetic, diaphoretic, errhine.	Arterial excitement, spinal spasms, pneumonia, typhoid, heart troubles, convulsions, tetanus, chorea, mania.	1–4 (.06–.26 Gm.).
1. Veratrina. 2. Veratrine.	Asagræa officinalis.	A mixture of alkaloids.	Mexico, S. America.	Veratrine, cevadine, veratridine, cevadilline, sabadine, sabadinine.	....	Sedative, powerful irritant, sternutatory, errhine.	Neuralgia, headache, sciatica, pediculi, rheumatism, pneumonia, sprains, heart trouble.	$\frac{1}{32}$–$\frac{1}{12}$ (.002–.005 Gm.).
Liliaceæ:								
1. Scilla. 2. Squill.	Urginea maritima.	The bulb.	Mediterranean Basin.	Scillitin, sinistrin, sugar, Ca oxalate.	Vinegar, syrup, fluidextr., comp. syrup, tincture.	Expectorant, cardiac stimulant, diuretic, emetic, cathartic, irritant.	Croup, coughs, bronchitis, asthma, dropsies, whooping-cough.	1–5–10 (.06–.3–.6 Gm.).
1. Aloe. 2. Aloes.	Aloe: Perryi, vera, ferox.	The inspissated juice.	E. Africa, Socotra, W. Indies, Curaçao, Cape of Good Hope.	Aloin, resin, emodin, volatile oil.	Pills, tincture, extr. coloc. co., pil. rhei co., tr. benz. co.	Cathartic, drastic, emmenagogue, vermifuge.	Costiveness, jaundice, hemorrhoids, amenorrhœa, ascarides.	½–10 (.03–.6 Gm.).
1. Colchici Cormus. 2. Colchicum Corm.	Colchicum autumnale.	The dried corm.	C. and S. Europe, N. Africa.	Colchicine, colchiceine, colchicoresin, starch, sugar, fixed oil.	Extract.	Alterative, cathartic, emetic, sedative, diuretic, diaphoretic.	Gout, rheumatism, skin affections, prurigo, urticaria, neuralgia.	2–8 (.13–.5Gm.).
1. Colchici Semen. 2. Colchicum Seed.		The dried seeds.			Fluidextr., tincture.			1–5 (.06–.3Gm.).
Smilaceæ:								
1. Sarsaparilla. 2. Sarsaparilla.	Smilax: medica, officinalis, ornata.	The dried root.	Trop. America, Mexico.	Sarsasaponin, parillin, smilasaponin, volatile oil, resin, starch, Ca oxalate, coloring.	Fluidextr., comp. syr., comp. fluidextract.	Alterative, diuretic, diaphoretic, tonic.	Blood purifier in scrofula, skin diseases, syphilis, abscesses, ulcers.	30–120 (2–8 Gm.).
Zingiberaceæ:								
1. Cardamomi Semen. 2. Cardamom Seed.	Elettaria Cardamomum.	The dried seeds.	Malabar, India.	Volatile oil, fixed oil, starch, salts.	Tinct., tinct. co., extr. colocy. co., pulv. arom., tr. gent. co., tr. rhei.	Carminative, stimulant, aromatic, condiment.	As adjuvant or corrective to cordials, tonics, purgatives, flavoring.	5–15 (.3–1 Gm.).

ZINGIBER. GINGER.

Zingiber officinale, *Roscoe.* { The dried rhizome, with outer cortical layers either partially or completely removed.

Habitat. India, Hindustan (cultivated in W. Indies, Africa).

Syn. Zingib., Jamaica, Black, African or Race Ginger; Fr. Gingembre (gris et blanc); Ger. Rhizoma (Radix) Zingiberis, Ingwer.

Zin′gi-ber. L. fr. Skt. *gringavera—gringa,* horn, + *vera,* body, horn-shaped —*i. e.,* shape of roots; Ar., Pers. *zanjabil, zenjebil;* Eng. *ginger.*

Of-fi-ci-na′le. L. *officina,* workshop; *opus,* work, + *facere,* to do—*i. e.,* used in the shop or store.

PLANT.—Perennial herb; stem barren, leafy, 1–1.3 M. (3–4°) high, entirely covered with the leaf-sheaths, solid, round; leaves 15–30 Cm. (6–12′) long, 2.5–4 Cm. (1–1$\frac{3}{5}$′) wide; flowering stalk from stem 15–30 Cm. (6–12′) long, terminating in a spike; flowers dingy yellow, 2–3 at a time. RHIZOME: *Jamaica,* free from outer corky layers, in horizontal, compressed, irregularly branched pieces, 4–16 Cm. (1$\frac{3}{5}$–6$\frac{2}{5}$′) long, 4–20 Mm. ($\frac{1}{6}$–$\frac{4}{5}$′) thick, light brown, longitudinally striate, ends of branches with depressed stem-scars, fracture short-fibrous, mealy, resinous; internally yellowish, light brown, cortex thin, endodermis a thin yellow layer enclosing a large central cylinder with many groups of fibro-vascular bundles and yellowish oil cells; odor agreeably aromatic; taste aromatic, pungent; *African,* cork partly removed on flattened sides, patches without cork smooth, light brown, portions with cork longitudinally or reticulately wrinkled and grayish-brown; fracture short-fibrous; internally lemon-yellow, dark bluish with yellowish oil-secretion cells and light yellow, reddish-brown resin cells; odor strongly aromatic; taste intensely pungent; *Calcutta,* resembles the African, but branches (fingers) somewhat larger, with many shriveled pieces, grayish-brown, grayish-blue; fracture short, mealy, horny; internally light yellow, light brownish-yellow with numerous yellowish oil cells and yellowish-brown resin cells; odor aromatic; taste starchy, strongly pungent; *Calicut,* resembles the African, but usually more of the periderm is removed, light brown, fracture short-fibrous, mealy; internally light yellow, brownish-yellow, numerous yellowish oil and resin cells; odor aromatic; taste very pungent; *Cochin,* most of corky layer removed on flattened sides, light brown, grayish-yellow; fracture short, mealy; internally yellowish-white, numerous yellowish oil cells and brownish-red, blackish resin cells; odor aromatic; taste pungent, not so persistent as the African; *Japanese,* resembles somewhat the Cochin, but usually with a thin coating of lime, nearly smooth, slightly wrinkled and of whitish color; fracture short, very mealy; internally yellowish-white, light brown, numerous brownish-red resin cells; odor aromatic; taste pungent. POWDER, yellowish-brown; microscopically—numerous starch grains, .005–.04 Mm. ($\frac{1}{5000}$–$\frac{1}{625}$′) long, sclerenchymatous fibres long, non-lignified, oil-secretion cells with yellowish, oily substance; cork cells absent in the Jamaica; yields 2 p. c. of non-volatile extract soluble in ether, and 4 p. c. of an extract soluble in alcohol. Should be kept in tightly-closed containers, adding occasionally a few drops of chloroform or carbon tetrachloride to prevent insect attack. *Solvents:* alcohol; acetone; ether; boiling water partially. Dose, gr. 5–20 (.3–1.3 Gm.).

ADULTERATIONS.—RHIZOME: Fibrous, light, friable, worm-eaten pieces (all discarded); POWDER: Rice starch, flour, curcuma, brick-dust, chalk, capsicum, mustard (detected by microscope, iodine T. S., ash), partially or wholly exhausted ginger.

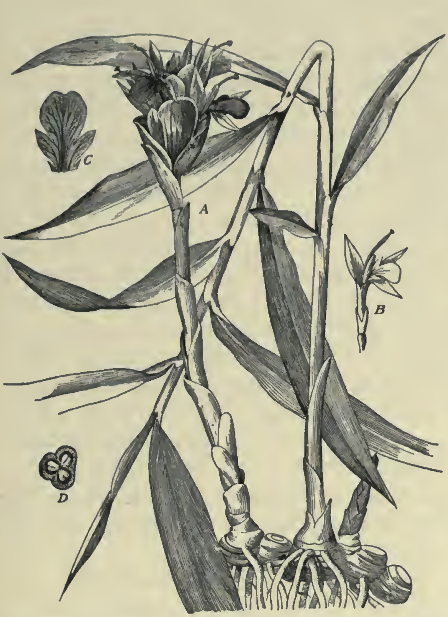


FIG. 66.—Zingiber: *A*, entire plant (¼ nat. size); *B*, flower; *C*, labellum; *D*, transverse section of ovary.

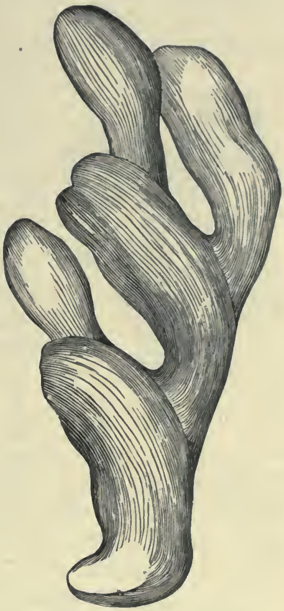


FIG. 67.—Jamaica ginger; uncoated.

Commercial.—Plant reed-like, is propagated by rhizome segments, thrives best on new forest soil, and yields when one or more years old (the younger the better) very acceptable rhizomes, which are dug after the stems have withered, Jan.–Feb., cleaned carefully to avoid bruising, hence discoloration, washed in boiling water to hydrate starch and prevent germination, and then rapidly dried, constituting as such *black, coated, unpeeled, unscraped ginger,* in contradistinction to the further prepared *white, uncoated, peeled, scraped, race, hand ginger*—the former, owing to most oil and resin residing in the periderm, being richer and stronger. May bleach artificially by sulphur fumes (SO_2), chlorinated lime (Cl), milk of lime, or gypsum. There are several varieties, five being given pharmacopœial prominence: 1, *Jamaica,* sometimes steeped in milk of lime, and covered with calcium carbonate, thereby preventing insect attack; least pungent, most delicate and handsome; reaches us via England, or direct from W. Indies; 2, *African,* generally recognized as possessing greater pungency but less acceptable aroma than the preceding, with shorter rhizome and broadly linear or oblong lobes; yields 8–10 p. c. of oleoresin; 3, *Calcutta* (*E. India*), resembles closely the African; reaches us via Calcutta; yields 8 p. c. of oleoresin; 4, *Calicut* (*E. India*), resembles closely the African; reaches us from Calicut; yields 8 p. c. of oleoresin; 5, *Cochin* (*Chinese*), resembles somewhat the Jamaica, but seldom enters our market commercially; 6, *Japanese*, resembles closely the Cochin, and seldom becomes a commercial article with us. The *green* (lobed branches recently dug and marketed without drying), and *preserved* (fresh rhizome steeped in hot syrup, becoming soft, brownish, translucent, efflorescent) are popular trade forms.

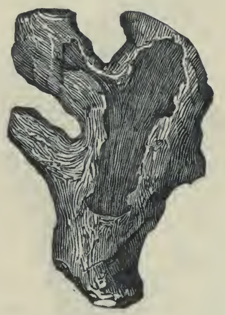


Fig. 68.—Calcutta ginger; coated.

Constituents. — Volatile oil 1–3 p. c., Gingerol .5–1.5 p. c., Resin (2), starch 20 p. c., mucilage, ash 4–8 p. c.

Volatile Oil.—Mostly phellandrene, $C_{15}H_{24}$, and *d*-camphene, $C_{10}H_{16}$; thickish, greenish-yellow; sp. gr. 0.885; gives aromatic odor and flavor, but not the pungency.

Gingerol.—Not a glucoside, but a straw-colored, viscid, inodorous, non-volatile, pungent liquid, imparting the hot taste; soluble in fat, benzene, carbon disulphide, volatile oils, alcohol, ether.

Preparations.—1. *Fluidextractum Zingiberis.* Fluidextract of Ginger. (Syn., Fldext. Zingib., Fluid Extract of Ginger; Fr. Extrait fluide de Gingembre; Ger. Ingwerfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: alcohol. Dose, ♏v–20 (.3–1.3 Ml. (Cc.).

Prep.: 1. *Syrupus Zingiberis.* Syrup of Ginger. (Syn., Syr. Zingib.; Fr. Sirop de Gingembre; Ger. Ingwersirup.)

Manufacture: 3 p. c. Mix fluidextract of ginger 3 Ml. (Cc.) and alcohol 2 Ml. (Cc.), triturate liquid with magnesium carbonate 1 Gm., sugar 6 Gm., gradually add, constantly triturating, water 43 Ml. (Cc.), filter, dissolve in clear filtrate, gently heating, sugar 76 Gm., strain syrup (hot), add water q. s. 100 Ml. (Cc.). Dose, ʒss–2 (2–8 Ml. (Cc.)).

2. *Oleoresina Zingiberis.* Oleoresin of Ginger. (Syn., Oleores. Zingib., Extractum Zingiberis Æthereum, Piperoid; Fr. Oléorésine (Piperoide) de Gingembre; Ger. Zingiberin, Ætherisches Ingwerextrakt.)

Manufacture: Percolate slowly, in a covered glass percolator, 100 Gm. with ether, added in successive portions, until exhausted, reclaim most of the ether on water-bath, transfer residue to a dish, allow remaining ether to evaporate spontaneously in a warm place; yield 5–10 p. c. Should be kept in well-stoppered bottles. Dose, ♏ss–2 (.03–.13 Ml. (Cc.)).

3. *Tinctura Zingiberis.* Tincture of Ginger. (Syn., Tr. Zingib., Tincture of Jamaica Ginger; Fr. Teinture de Gingembre; Ger. Ingwertinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: alcohol. *Tests:* 1. Evaporate to dryness 10 Gm.—residue 2 p. c., which treated with cold distilled water 20 Ml. (Cc.)—dissolves 15 p. c. *Impurities:* Capsicum, similar pungent substitutes. Dose, ♏xx–60 (1.3–4 Ml. (Cc.)).

Prep.: 1. *Acidum Sulphuricum Aromaticum,* 5 p. c.
4. *Pulvis Aromaticus,* 35 p. c. 5. *Pulvis Rhei Compositus,* 10 p. c.
Unoff. Preps.: Infusion, dose, ℥j–2 (30–60 Ml. (Cc.)). *Troches.*

PROPERTIES.—Like other aromatics, carminative, stimulant, sternutatory, rubefacient, anodyne, sialagogue. This was introduced from Asia, through Arabia into Greece and Europe. The Arabian and Greek physicians used it as a condiment, carminative, stimulant, aphrodisiac.

USES.—Atonic dyspepsia, flatulent colic, atonic gout, diarrhœa, cholera, chronic bronchitis, corrective to nauseous medicines. Externally—colic, rheumatism, neuralgia, toothache, headache; in cataplasms, fomentations. The infusion for relaxed uvula, masticated for paralysis of tongue.

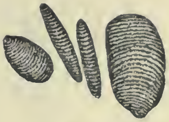


FIG. 69.—Ginger starch granules: magnified 250 diam.

Allied Plants:

1. *Zingiber Zerum'bet.*—Java (rhizome fleshy, spongy, ginger odor and taste), and *Z. Cassumu'nar.*—India (root 5 Cm.; 2′ long, fleshy radicles, white tubers, scaly, brown; odor and taste camphoraceous).

2. *Cur'cuma lon'ga, Turmeric.*—The rhizome, official 1820–1880; S. Asia, Indian Ocean Islands. Plant is a perennial; leaves radical, 1 M. (3°) long, lanceolate; flower-scape short, spike 15 Cm. (6′) long, flowers orange-yellow, in pairs; rhizome 2.5–5 Cm. (1–2′) long, 12 Mm. (½′) thick (long turmeric) to 18–25 Mm. (¾–1′) thick (round turmeric), sometimes in sections, yellowish-gray, annulate, inside orange-yellow, fracture resinous; odor ginger-like; taste warm, aromatic; contains volatile oil 1 p. c., viscid oil 11 p. c., pungent resin, curcumin (coloring matter) .3 p. c., starch, ash 5–7 p. c. Powder deep yellow, brownish-red by alkalies or borax. There are several varieties: 1, Madras (best, bright yellow, often in cut pieces—Pubna preferred); 2, Bengal (reddish, mostly round); 3, Java (reddish-gray); 4, Chinese (often branched); 5, Cochin (possibly from *C. viridiflo'ra*). Used as stimulant, tonic, aromatic, condiment, for jaundice, and as ginger; tincture, 15 p. c. (diluted alcohol) for coloring ointments, solutions, etc.

3. *C. Zedoa'ria, Zedoary.*—India. Rhizome (tuber) occurs as *long* and *round,* varying in size, 12–37.5 Mm. (½–1½′) long, usually met with in circular disks, 12–37.5 Mm. (½–1½′) broad, 4–16 Mm. (⅙–⅔′) thick; it is orange-brown, internally pale, reddish-gray-brown, with many brownish resin-cells and lighter colored wood-bundles; fracture short, mealy; odor and taste ginger-like; contains volatile oil .5–1 p. c.,

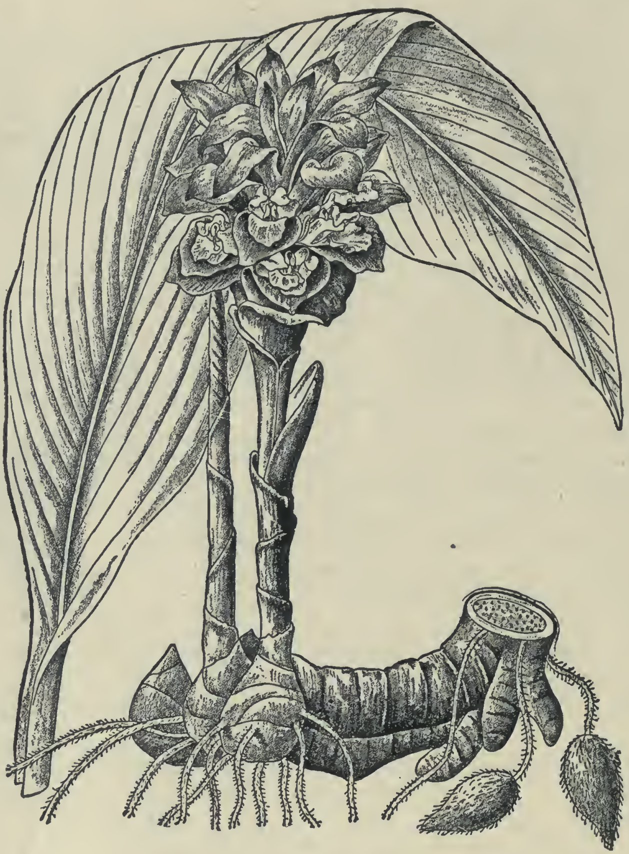


FIG. 70.—Turmeric rhizome and stem.

resin (pungent taste), starch, mucilage; weaker than ginger. Dose, gr. 10–30 (.6–2 Gm.); bitter tincture, 25 p. c., + aloes 12.5, etc.

4. *Alpin'ia officina'rum, Galanga* (*Galangal*). —China. Rhizome cylindrical, branched, 5 Cm. (2′) long, 15 Mm. ($\frac{3}{5}$′) thick, annulate from leaf-sheaths, rust-brown, fracture short, fibrous, inside yellowish, with many brownish

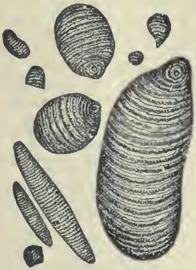


FIG. 71.—Curcuma starch.

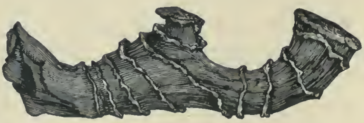


FIG. 72.—Galanga.

resin-cells, scattered wood-bundles; odor and taste ginger-like; contains volatile oil .5 p. c., resin, gum, bassorin, fat, galangol, galangin, kæmpferid, alpinin, starch 23 p. c. Used like ginger in same dose.

5. *Al′etris farino′sa, Colic Root* (*Starwort*).—Rhizome, official 1820–1870; United States. Perennial, .6–1 M. (2–3°) high; leaves radical, star-shape, 7.5–10 Cm. (3–4′) long, 2.5 Cm. (1′) wide; flowers white, as though dusted with meal; rhizome 2.5 Cm. (1′) long, 3 Mm. ($\frac{1}{8}$′) thick, upper side flattened, root whitish, taste amylaceous, bitter; contains starch, bitter principle. Used as tonic, diuretic, uterine tonic, emetic, purgative for colic, dropsy, chronic rheumatism; in decoction, fluidextract (dil. alc.), tincture. Dose, gr. 5–10 (.3–.6 Gm.).

13. ORCHIDACEÆ. Orchid Family.

Or-ki-da′se-e. L. *Orchi*(*s*)*d* + aceæ, fr. Gr. ὄρχις, a testicle—*i. e.*, ancient name from shape of roots. Herbs, shrubs, terrestrial or epiphytical. Distinguished by flowers being perfect, irregular, reptile-shape, perianth 6, in 2 whorls, petaloid, superior; leaves sheathing, entire; anthers 1–2, sessile, united to style (gynandrous); pollen cohering in masses; ovary 1-celled, inferior, long, 3-angled; capsule 3-valved; universal; aromatic, antispasmodic, nutrient, aphrodisiac, flavoring, beautiful flowers.

Genus: **1. Vanilla.**

VANILLA. VANILLA.

Vanillinum. Vanillin, $C_8H_8O_3$, *official.*

Vanilla planifolia, *Andrews.* { Methylprotocatechuic aldehyde occurring naturally in vanilla (cured fruit), or prepared synthetically.

Habitat. E. Mexico, hot, damp woods, forests; cultivated in tropics.

Syn. Vanilla Aromatica, Vaniglia; Fr. Vanille, Vanilline; Ger. Fructus (Siliqua) Vanillæ, Vanillin.

Va-nil′la. L. fr. Sp. *vainilla*, formerly *vaynilla*, dim. of *vaina* (*vayna*), scabbard, sheath, pod, lit. "little pod"—*i. e.*, pod resembling the sheath of a knife.

Pla-ni-fo′li-a. L. *planus*, flat, + *folium*, leaf, flat-leaved—*i. e.*, leaves plain or flat, without prominent veins.

Plant.—Succulent, dark green, epiphytic, terrestrial or parasitic, perennial climber; stem long, 1–2 Cm. ($\frac{2}{5}$–$\frac{4}{5}$′) thick, smooth, much branched, nodes with aërial roots and rootlets, 12.5–15 Cm. (5–6′) long, for clinging to trees, frame-work, etc., leaves 10–15 Cm. (4–6′) long, oval, tough, fleshy, veinless, dark green, paler beneath; flowers 5 Cm. (2′) broad, pale yellowish-green, loose axillary racemes of 8–10. Fruit (pod), linear, flattened, tapering, 15–35 Cm. (6–14′) long, 5–9 Mm. ($\frac{1}{5}$–$\frac{1}{3}$′) broad, in clusters of 3–15, flat circular scar at summit, curved (hooked) at base (Tahiti variety—middle broad, tapering similarly toward either end), blackish-brown, longitudinally wrinkled, moist-glossy, occasionally with efflorescence of vanillin acicular crystals, and 3-divided near tip; frequently cork patches; flexible, tough, 1-locular, blackish-brown pulp and many triangular, reticulate seeds,

.25–.30 Mm. ($\frac{1}{100}$–$\frac{1}{75}$′) broad; odor and taste characteristic, very agreeable. *Test:* 1. Efflorescent crystal on slide, + 1 drop of phloroglucinol T. S. and hydrochloric acid—carmine-red (dist. from benzoic acid); solvent: 75 p. c. alcohol. Dose, gr. 5–30 (.3–2 Gm.).

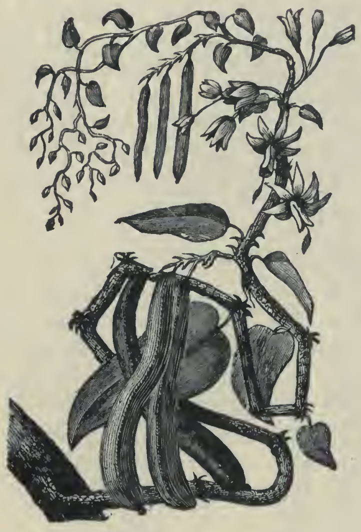


Fig. 73.—*Vanilla planifolia.*

Commercial: Plant mostly cultivated, since 1850, from cuttings, sometimes seeds, in Papantla, Misantla, Vera Cruz, Oaxaca provinces, where moisture is abundant and temperature never below 18° C. (65° F.); it climbs by rhizoids (non-absorbing roots), pollinates by insects, hand; bears fruit 3rd year, continues 30–40; fruit (cured, full-grown, unripe) develops in 2–3 months, but a longer time is required for maturing, and when collected (late autumn before quite ripe, as green begins disappearing into yellow, to avoid splitting) is placed in heaps, sheltered from sun and rain, to undergo partial fermentation and shriveling, then followed by the process of "sweating"—exposure to sun or stove heat (60° C.; 140° F.) until a fine chestnut-brown color is acquired, and the odorous principle, vanillin, has been developed from the normal coniferin (secreted by the internal hair-like fibrillæ), which is converted by hydrolization into glucose and coniferic alcohol, then this latter by an oxydase into vanillin—the object being to drive moisture out upon the surface and finally

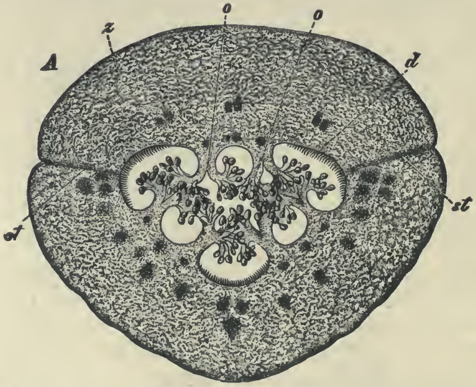


Fig. 74.—Vanilla fruit, cross-section magnified: *z*, fruit flesh; *st*, opening suture; *o*, seed placentæ; *d*, papillæ.

drying the latter; the process may be aided by the sweating-box, steaming, wrapping in blankets, etc.; they now are dried by a 2-months' exposure to the sun, then coated with oil (that which exudes, also cocoa and cashew nut), tied in small bundles of 50–75, wrapped in foil, and marketed; by insufficient drying, to retain weight, the interior of beans and wherever tied sometimes become moldy. There are several varieties: 1, *Mexican* (*Vera Cruz*), best, but beans vary much in value; 2, *Bourbon*, from Isle of Réunion, resembles Mexican, but beans blacker, tapering portion shorter, less firm and fleshy, surface smooth, waxy, soon becoming coated with acicular crystals (frost); odor more like Tonka bean; 3, *Mauritius* (*Seychelles*), often sold as inferior Bourbon; beans only 15 Cm. (6′) long, 6 Mm. (¼′) broad, pale color, smooth, not waxy, faint odor; 4, *South American* (*Guadeloupe*), resembles Mexican, but broader, flatter, often 12 Mm. (½′) broad, reddish-brown, odor of fermented molasses, pulpy, resinous, few crystals on surface, beans often open and seeds on the surface; 5, *Tahiti*, transplanted Mexican; beans 15 Cm. (6′) long, 12 Mm. (½′) broad, reddish-brown, heliotrope odor; 6, *Java*, mostly consumed in Holland, beans 10–15 Cm. (4–6′) long, fine flavor of Mexican but odor much more powerful; 7, *Vanillons* (*Brazilian—V. Pompo'na*), larger, thicker than S. American, inferior vanilla odor (heliotrope), used by perfumers, tobacconists; contains vanillin .5 p. c. Beans also are imported from Honduras, Madagascar, Martinique, etc., while some occur on the market deprived by a solvent of vanillin, and others to which benzoic acid, etc., have been added; all may be purchased as "splits" and "cuts."

CONSTITUENTS.—FRUIT: Vanillin (Mexican 1.7 p. c., Bourbon 2 p. c., Java 2.75 p. c., in the 2 last associated with odorous oil), fixed oil 11 p. c., resin, sugar, mucilage, ash 4–6 p. c.

Vanillinum. Vanillin. This is obtained (1) by crushing the pods (fruit) with sand, extracting with ether in a Soxhlet tube, shaking out ethereal extract with sodium sulphite solution, liberating vanillin from this by treating with sulphuric acid, expelling sulphurous acid generated, extracting with ether; (2) by slowly adding a concentrated solution of coniferin, $C_{16}H_{22}O_8$, from cambium sap of pines, to a warm solution of potassium dichromate in water and sulphuric acid, finally heating to boiling for 3 hours—coniferin, by hydrolysis from action of acid, is converted into dextrose and coniferyl alcohol, and this latter oxidizes into vanillin and aldehyde: $C_{16}H_{22}O_8 + H_2O = C_6H_{12}O_6 + C_{10}H_{12}O_3$; $C_{10}H_{12}O_3 + O = C_8H_8O_3 + C_2H_4O$—passing steam through mixture, or adding successive portions of ether, filtering, reclaiming ether, when vanillin crystallizes; (3) by boiling eugenol, $C_{10}H_{12}O_2$, with acetic anhydride, forming acetylisoeugenol, $C_{10}H_{11}(C_2H_3O)O_3$, which is oxidized with potassium dichromate into acetylvanillin—the latter upon treating with potassium hydroxide solution and concentrating being converted into vanillin, which may be removed by acidulating filtrate with sulphuric acid and shaking out with ether; this method, owing to economic reasons, is used chiefly. It is in fine, white, slightly yellowish, crystalline needles, odor and taste of vanilla, 400 times stronger than the pod, soluble in alcohol, glycerin, chloroform, ether, water (100), hot water (16), aqueous solutions of alkali hydroxides, from which it is precipitated by acids; melts at 81° C. (178° F.); incinerate 2 Gm.—ash .05 p. c.; aqueous solution acid, optically inactive. *Tests:* 1. Aqueous solution with ferric chloride T. S.—blue color, changed to brown on boiling, and on cooling—white precipitate (dihydrodivanillin). 2. Shake ethereal solution with saturated aqueous solution of sodium bisulphite, add sulphuric acid —vanillin precipitated. 3. Cold aqueous solution with lead acetate, T. S.—white precipitate (lead compound of vanillin), soluble in hot water. *Impurities:* Acetanilid, benzoic acid, boric acid, terpin hydrate coumarin, 50–90 p. c. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{6}$–$\frac{1}{2}$ (.01–.03 Gm.).

PREPARATIONS.—(*Unoff.*) FRUIT: *Fluidextract. Syrup. Tincture,* 10 p. c. (dil. alc., + sugar 20 p. c.). VANILLIN: *Comp. Elixir. Comp. Spirit,* 20 p. c. (alc.).

PROPERTIES. — Carminative, stimulant, aphrodisiac, antihysteric, irritant. Those working in it have itching hands, face, neck (the skin being covered with pruriginous eruptions), dizziness, weariness, muscular pains; eruptions due to an *acarus* which does not enter the skin.

USES.—The Spanish conquerors found vanilla in use in Mexico for flavoring chocolate, etc., and while now recommended for hysteria, it is employed chiefly as a flavoring agent, being the most general of all substances; large quantities sometime produce poisonous symptoms.

Allied Plants:

1. *Vanilla Pompo'na,* Guadeloupe variety, *V. Gardne'ri,* Brazilian and Bahia, *V. odora'ta, V. phœan'tha,* Jamaica, Trinidad.

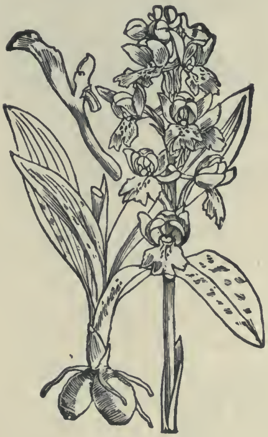


FIG. 75.—*Orchis mascula.*

2. *Or'chis mas'cula* (+ other species), *Salep.* The fecula of the root, official 1820–1830; C. and S. Europe; rich woods. Small herb 15–45 Cm. (6–18′) high, leaves parallel-veined, sheathing; flowers pinkish, showy, nectariferous spur underneath; root (tubers) consists of 2 fleshy tubers 2.5 Cm. (1′) long, deprived of epidermis by scalding in water; yellowish-brown, hard, translucent, horny, insipid; contains starch 27 p. c., mucilage 48 p. c.; starch obtained by grinding root under water, straining, subsiding. Used as demulcent, nutritive diet for infants, children, chronic diarrhœa, cholera infantum, tuberculous diarrhœa, in mucilage (1 part + water 50). *Adulterations.*—TUBERS: Colchicum corm, this latter being recognized by its side groove and sweet, bitter, acrid taste; POWDER: Starch, flour, which can readily be distinguished by microscope. Dose, *ad libitum.*

3. *Cypripe'dium hirsu'tum (pubes'cens), C. parviflo'rum, Ladies' Slipper.*—The dried rhizome and roots, official 1860–1910; N. America, woods, swampy places. Perennial hairy herbs, .3–.6 M. (1–2°) high; leaves ovate, 10–12.5 Cm. (4–5′) long; flowers yellow, 4-divided, moccasin-shape. Rhizome curved, 3–10 Cm. ($1\frac{1}{5}$–4′) long, 2–6 Mm. ($\frac{1}{12}$–$\frac{1}{4}$′) thick, orange-brown, brownish, many cup-shape scars above, and wavy roots below, 3–15 Cm. ($1\frac{1}{5}$–6′) long, fracture short (roots fibrous); odor distinct, valerian-like; taste sweetish, bitter, pungent; solvents: boiling water, diluted water; contains volatile oil, resin (2), fixed oil, volatile acid, tannin. Antiperiodic, nervous stimulant, diaphoretic; cholera, hysteria, epilepsy, nervousness, hypochondriasis, neuralgia, insomnia—substitute for valerian. Dose, gr. 15–30 (1–2 Gm.); fluidextract (diluted alcohol), ♏15–30 (1–2 Ml. (Cc.)); "Eclectics" resinoid cypripedin, gr. 1–2 (.06–.13 Gm.).

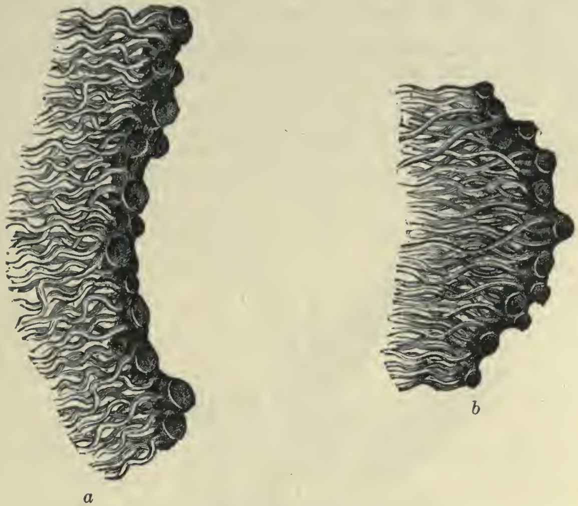


FIG. 76.—*a, Cypripedium hirsutum (pubescens)*: rhizome and roots, natural size. *b, Cypripedium parviflorum:* rhizome and roots, natural size.

SUB-CLASS 2: **DICOTYLEDONES (Embryo with 2 cotyledons, stem exogenous (with pith, wood, bark), leaves net-veined).**

SERIES 1: CHORIPETALÆ. Petals separate and distinct, or wanting.

14. PIPERACEÆ. Pepper Family.

Pip-e-ra'se-e. L. *Piper* + aceæ, Gr. πίπερι, Skt. *pipala*, Bengalese *pippul*, fr. Gr. πέπτω, to digest—*i. e.*, it aids digestion. Herbs, shrubs. Distinguished by jointed stems; leaves entire; flowers perfect, without floral envelopes, spikes; ovary 3–5, somewhat united, 1-celled; ovule 1, stigma 2–4; fruit somewhat fleshy, 1-celled, 1-seeded; tropics; acrid, pungent, aromatic, stimulant (volatile oil + resin).

Genus: **1. Piper.**

CUBEBA. CUBEB.

Piper Cubeba, *Linné filius.*
(**Cubeba Cubeba,** (*Linné filius*) *Lyons.*)

The dried, full-grown, unripe fruits, with not more than 5 p. c. of stems, foreign matter.

Habitat. Java, Sumatra, Borneo; cultivated in two former islands, and in W. Indies, Ceylon.

Syn. Cubeb., Cubebs, Tailed Cubebs, Cubeb-, Java-, or Tailed-Pepper; Br. Cubebæ Fructus (Baccæ), Piper Caudatum; Fr. Cubèbe, Poivre à Queue; Ger. Cubebæ, Kubeben.

Pi'per. L. see etymology, page 139, of Piperaceæ.

Cu-be'ba. L. fr. Gr. *κουβέβα,* of Actuarius; name used since the 10th century; Pers. *kababa,* their native name of the plant.

Plant.—Climbing woody perennial; stem jointed, flexuous, 6 M. (20°) high; leaves 15 Cm. (6′) long, lanceolate, leathery, shining, nerved, petiolate; flowers diœcious, spikes, 2.5–5 Cm. (1–2′) long. Fruit, upper portion globular, 3–6 Mm. ($\frac{1}{8}$–$\frac{1}{4}$′) broad, with a straight, slender, stem-like portion (stipe, thecaphore—not a true pedicel, but stigma remnant), 5–7 Mm. ($\frac{1}{5}$–$\frac{1}{4}$′) long; pericarp, with immature seed attached at its base, grayish-black, coarsely reticulate, .3 Mm.

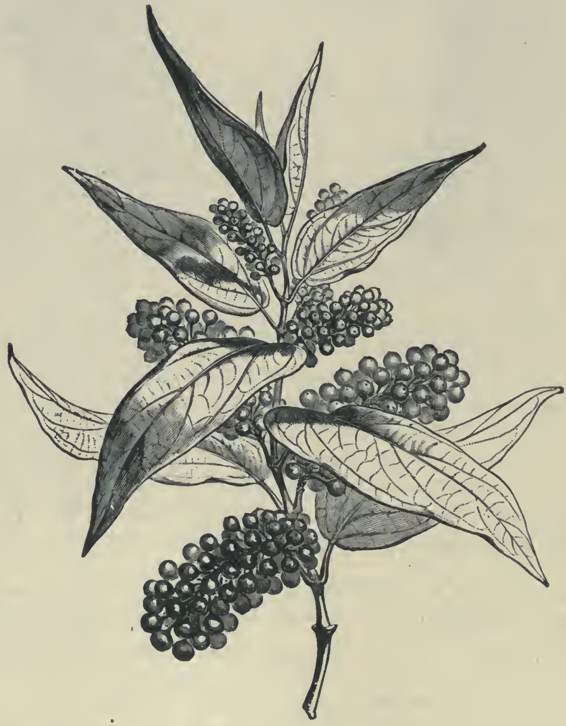


Fig. 77.—*Piper Cubeba.*

($\frac{1}{75}'$) thick, easily cut, 1-locular, 1-seeded; odor aromatic, characteristic; taste strongly aromatic, pungent. Powder, brownish; microscopically—starch-bearing cells of perisperm and fragments of pericarp with stone cells, many starch grains, .002–.012, Mm. ($\frac{1}{12500}$–$\frac{1}{2000}'$) broad, and stone cells, secretion cells with yellowish, oily content, reddish with sulphuric acid; few fragments of stalk, tracheæ, sclerenchymatous fibres; non-volatile extractive, soluble in ether, 10 p. c. *Solvents:* ether; alcohol. Dose, gr. 15–60 (1–4 Gm.).

Adulterations.—Fruit: Rachis or stalks (inodorous, increasing fibro-vascular tissue and ash), partially grown fruit, siftings (darker and without starch masses), black pepper and other piperaceous fruits (*P. cani'num, P. cras'sipes, P. Lo'wong, P. mollis'simum, P. ribesoi'des, P. Clu'sii, Sit'sea citra'ta*, etc.), all distinguished by characteristic shape, odor, and taste. *Rhamnus cathartica* fruit (pedicellate and contains 4 seeds), allspice (much larger, 2-seeded, no pedicel). *Juniperus communis* fruit (much larger, different taste); Powder: Deteriorates unless kept in tight containers, hence best to powder only when needed, sometimes mixed with powdered allspice, flour, or starch.

Commercial.—Plant grows extensively in coffee plantations or on grounds reserved for the purpose, being supported usually on shade trees; fruit is gathered when full-grown, but before ripe—still of a green color—dried carefully in the sun, and exported from Java to Singapore, whence it enters market.

Constituents.—Volatile oil 5–15 p. c., Resin 2.5–3.5 p. c., Cubebin .4–3 p. c., Cubebic acid 1–3.5 p. c., fixed oil 1 p. c., gum 8 p. c., starch, ash 5–8 p. c. (cubeb stalks 10 p. c.).

Oleum Cubebæ. Oil of Cubeb, *official.*—(Syn., Ol. Cubeb., Cubeb Oil, Oleum Cubebarum, Oil of Cubebs; Fr. Essence de Cubèbe; Ger. Kubebenöl.) This volatile oil, distilled with water or steam from the unripe fruit, is a colorless, pale green, yellowish-green liquid, characteristic odor and taste of cubeb, sp. gr. 0.915, lævorotatory, soluble in equal volume of alcohol, neutral reaction; contains a little dipentene, $C_{10}H_{16}$, but mostly sesquiterpene, cadinene, $C_{15}H_{24}$. If old, or distilled from old fruit, has additionally an inodorous stearoptene, cubeb camphor, $C_{15}H_{24}.H_2O$, which soon deposits. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏v–20 (.3–1.3 Ml. (Cc.)).

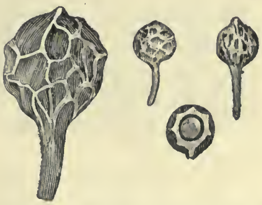


Fig. 78.—Cubeb: fruit, natural size, and magnified.

Resin.—Extracted by ether, which also takes up volatile oil, fixed oil, cubebin, chlorophyll, and wax; evaporate off volatile oil, when cold cubebin and wax deposit; decant from these, separate fat and have left the resin, which is amorphous, soluble in alkalies, alcohol, not precipitated by alcoholic solution of lead acetate.

Cubebin, $C_{10}H_{10}O_3$.—This constitutes the precipitate from oleoresin upon standing; it is white, crystalline, inodorous, inert; alcoholic solution bitter.

Cubebic Acid, $C_{14}H_{16}O_4$.—Brownish, resin-like mass, soluble in alkalies, alcohol, ether, chloroform, precipitated by lead acetate; diuretic. Dose, gr. 5–10 (.3–.6 Gm.). Last three are red with sulphuric acid.

Preparations.—1. *Oleoresina Cubebæ.* Oleoresin of Cubeb. (Syn., Oleores. Cubeb., Extractum Cubebæ Æthereum; Fr. Oléorésine de Cubèbe; Ger. Extractum Cubebarum (Ætherisches), Kubebenextrakt.)

Manufacture: Percolate slowly, in a covered glass percolator, 100 Gm. with alcohol, added in successive portions, until exhausted, reclaim most of the alcohol on water-bath, transfer residue to a dish, allow remaining alcohol to evaporate spontaneously in a warm place, stirring frequently; after standing some time it deposits a waxy, crystalline precipitate, which should be rejected, and only the liquid portion dispensed (used), containing fixed oil, volatile oil, resin, chlorophyll; yield 18–25 p. c. Should be kept in well-stoppered bottles. Dose, ♏v–30 (.3–2 Ml. (Cc.)).

Prep.: 1. *Trochisci Cubebæ.* Troches of Cubeb. (Syn., Troch. Cubeb.; Fr. Pastilles de Cubèbe; Ger. Kubebenpastillen.)

Manufacture: Rub together until thoroughly mixed extract of glycyrrhiza 25 Gm., acacia 12 Gm., add oleoresin of cubeb 2 Gm., oil of sassafras 1 Ml. (Cc.), incorporate, form mass with syrup of tolu q. s., divide into 100 troches. Dose, 1–5 troches.

Unoff. Preps.: Extract, dose, gr. 2–10 (.13–.6 Gm.). *Fluidextract* (alcohol), dose, ♏xv–60 (1–4 Ml. (Cc.)). *Infusion,* 5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)). *Tincture,* 20 p. c. (alcohol), dose, ʒss–2 (2–8 Ml. (Cc.)).

Properties.—Diuretic (resin + cubebic acid), stimulant, carminative, expectorant, disinfectant, local irritant (volatile oil), may cause headache, giddiness, nausea, purging, paralysis; it is eliminated by bronchial mucous membrane, skin, and kidneys, all being stimulated and the increased secretions disinfected; imparts to urine a peculiar odor.

Uses.—Gonorrhœa, urethritis, vesical irritability, cystitis, abscess of prostate gland, piles, chronic bronchitis, catarrh. Arabians used it similarly to black pepper, and were the first to introduce it into Europe.

Allied Plants:

1. *Piper Lo'wong* (*Cubeba Lowong*) and *P. ribesoi'des* (*C. Wallich'ii*), fruit of both much like the official.

2. *P. cani'num* (*C. canina*), fruit smaller than official, contracted below into a stalk half the length of the globular portion, and *P. cras'sipes* (*C. crassipes*), fruit larger than the official.

3. *False Cubebs.*—Origin unknown, fruit wrinkled, brownish-gray, size of the official, stalk 5 Mm. ($\frac{1}{5}'$) long, odor mace-like.

PIPERACEÆ

PIPER. PEPPER.

Piper nigrum, *Linné.* { The dried, unripe fruit, with not more than 2 p. c. of stems, foreign matter.

Habitat. S. India, Malabar Coast, Philippine Islands, Sumatra, Java, Singapore, Ceylon, Penang, Luzon, Borneo, Malacca, Siam, W. Indies; cultivated.

Syn. Black Pepper, Peppercorn, African Black-, Common-, Cubeb-Pepper, Pepper Plant or Vine, Piper Nigrum; Fr. Poivre noir (common); Ger. Schwarzer Pfeffer.

Ni'grum. L. *niger*, black, fr. *nec*, to die, as seen in Gr. *νεκρός*, dead, *nox*, night—*i. e.*, color of the brownish-black fruit when compared with other varieties.

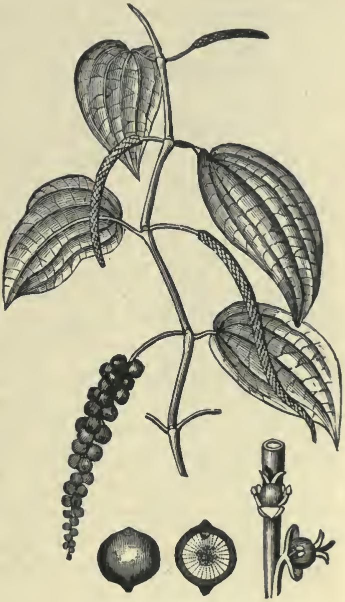


Fig. 79.—*Piper nigrum.*

Plant.—Perennial evergreen, diœcious climber; stem 6–9 M. (20–30°) long, articulated, smooth, woody, joints thickened, from which adventitious rootlets arise for adhering to support or taking root in the soil; leaves 10–15 Cm. (4–6′) long, ovate, petioles 12 Mm. ($\frac{1}{2}'$) long, acute at base and apex, entire, smooth, leathery, dark green, 5–7-nerved; flowers whitish, unisexual, sessile, elongated spikes. Fruit, berry-like, sessile, green, then red, and when ripe yellow, nearly globular, 3.5–6 Mm. ($\frac{1}{7}$–$\frac{1}{4}'$) broad, epicarp very thin, easily separable from the sarcocarp, grayish-black, coarsely reticulate, unilocular, 1-seeded; seed nearly white, hollow, adhering to pericarp; odor aromatic, slightly empyreumatic; taste aromatic, very pungent. Powder, grayish-black; microscopically — blackish-brown fragments of pericarp and nearly white of endosperm and embryo, starch grains .001–.003 Mm. ($\frac{1}{25000}$–$\frac{1}{8300}'$) broad, stone cells of epicarp and endocarp with reddish-brown substance, oil cells with yellowish oil from which piperine prisms may separate. *Solvents:* ether; acetone; alcohol; water partially. Dose, gr. 5–20 (.3–1.3 Gm.).

Adulterations.—Fruit: That of allied species, stalks, chaff, siftings, vetch and grape seeds, ivory nut, cinnamon, calcium oxalate, sawdust (pine), mace; Powder: Starches (yam, sweet potato, damaged flour, rice—the latter having same shaped granule as pepper starch, the quantity aiding detection); mustard, husks, flaxseed, capsicum—all recognized by microscope; pepper shells removed in layers, giving "first grinding," etc., the outer being successively weaker; sand, aniline, thalline, naphthylamine, shells of walnuts, almonds, cocoanuts (raw or roasted), olive stones—increasing ash 12.9–18.3 p. c.

Commercial.—Our supply comes from Singapore, Sumatra, and Java, where plants are propagated by cuttings which are planted at the roots of trees, chiefly betel, and trained to run thereupon as a support, thus allowing the land to yield two products. When the basal fruits begin changing from green to red the whole spike is gathered; if allowed to remain on until ripe they are eaten by birds, fall to the ground, and are less pungent. Vines yield 8–10 pounds (3.5–4.5 Kg.) annually, begin bearing when 2–4 years old, and decline after fifteenth year. The day after gathering the spikes are deprived of fruit, which is cleaned of stalks by picking, rubbing, etc., and dried at once by sun or fire, or after a slight boiling. There are several varieties or grades usually recognized by relative weight: (*a*) *Heavy*—1, *Malabar*, via Tellicherry, heaviest; 2, *Penang*, strongest; 3, *Singapore*, darkest; 4, *Straits Settlements*, principal and best product; (*b*) *Light*—5, *Cochin*; 6, *Siam*. These are mixed often in England, taking Malabar for weight, Penang for strength, Singapore (Sumatra) for color.

CONSTITUENTS.—Piperine 5–8 p. c., Piperidine .56 p. c., Volatile oil 1–2 p. c., Resin (pungent), Chavicin, Piperic acid, starch 25–40 p. c., fixed oil 7 p. c., proteids 12 p. c., non-volatile extract (soluble in ether) 6 p. c., ash (increasing with age and ripeness—thickness of pericarp) 4.5–7 p. c., of which 2 p. c. is insoluble in diluted hydrochloric acid.

Piperine, $C_{17}H_{19}NO_3$.—This feebly basic substance is obtained from pepper and other Piperaceæ plants by treating alcoholic extract with potassium hydroxide solution, which dissolves resin and saponifies fat, washing residue with water, filtering, treating residue on filter repeatedly with alcohol, from which piperine crystallizes. It is in pale yellow, glistening, monoclinic crystals, odorless, at first tasteless, afterward sharp and biting, permanent, no residue, soluble in alcohol (15), ether (36), chloroform (1.7), imparting most, if not all of the pungency. Dose, febrifuge, gr. 1–5 (.06–.3 Gm.).

Piperidine, $C_5H_{11}N$.—Obtained by dry distillation of piperine with soda-lime; it is a colorless liquid alkaloid, ammoniacal, peppery odor, when largely diluted bitter, soluble in water, alcohol, readily forms with acids crystallizable salts (hydrochloride, etc.).

Volatile Oil, $C_{10}H_{16}$.—Obtained by distillation with water or steam; it is nearly colorless, sp. gr. 0.880, imparts the odor but not pungency, soluble in alcohol (15); contains dipentene, phellandrene, terpene. The commercial *oil of black pepper* (Oleum Piperis) is the volatile oil, fixed oil, and pungent resin, being a by-product in making piperine, consequently is very similar to the oleoresin. Dose, ♏j–3 (.06–.2 Ml. (Cc.)).

Chavicin.—Obtained by neutralizing the potassium hydroxide solution (for piperine) with an acid; it is a soft, pungent resin, whose pungency depends upon the presence of piperine and piperidine; soluble in alkalies, alcohol, ether.

PREPARATIONS.—1. *Oleoresina Piperis.* Oleoresin of Pepper. (Syn., Oleores. Piper., Extractum Piperis Fluidum, Fluidextract of Black Pepper; Fr. Oléorésine de Poivre noir; Ger. Ætherisches Pfefferextrakt.)

Manufacture: Percolate slowly, in a covered glass percolator, 100 Gm. with ether, added in successive portions, until exhausted, reclaim most of the ether on water-bath, transfer residue to a dish, allow remaining ether to evaporate spontaneously in a warm place, and after the piperine has ceased to deposit separate the two by straining through purified cotton; contains fixed oil, volatile oil, holding in solution pungent resin and some piperine, the latter, precipitating on standing, being rejected; yield 5–6.5 p. c. Should be kept in well-stoppered bottles. Dose, ♏ss–2 (.03–.13 Ml. (Cc.)).

Unoff. Preps.: Fluidextract, dose, ♏v–20 (.3–1.3 Ml. (Cc.)). *Plaster* (oleoresin 1 gr. (.06 Gm.) to every 4 square inches + resin plaster q. s.). *Confectio Piperis* (Br.), 10 p. c., dose, ʒj–2 (4–8 Gm.). *Poultice.*

PROPERTIES.—Stimulant, tonic, febrifuge, irritant, rubefacient, carminative, antipyretic. Stimulates secretion of mouth, stomach, kidneys; excessive doses give abdominal heat, thirst, vomiting, fever, convulsions, increases urine, irritates bladder, urethra, and may cause urticaria.

USES. — Intermittents, enlarged lymphatic glands, gargles to stimulate throat, gums, plasters for muscular rheumatism, headache, colic, also for flatulence, indigestion, head-lice, gleet, leucorrhœa, gonorrhœa, fistula, paralysis of tongue. From Hippocrates' time down as a condiment, and as such today ranks next to salt the world over.

Allied Plants:

1. *Piper officina'rum* (*lon'gum*), *Long Pepper.*—The immature fruit dried in the sun, official 1830–1840; Java, India, Ceylon, Philippine Islands, Bengal. Shrub like official; leaves cordate; flowers spikes; fruit spike-like cone 2.5–4 Cm. ($1–1\frac{3}{5}'$) long, 5 Mm. ($\frac{1}{5}'$) thick, cylindrical, uneven, dusty, blackish-gray, the many coalesced fruits spirally arranged, each crowned with style remnant; odor, taste, properties, and composition like official. The Bengal long pepper is darker and shorter (2.5 Cm.; 1′ long) than that from elsewhere.

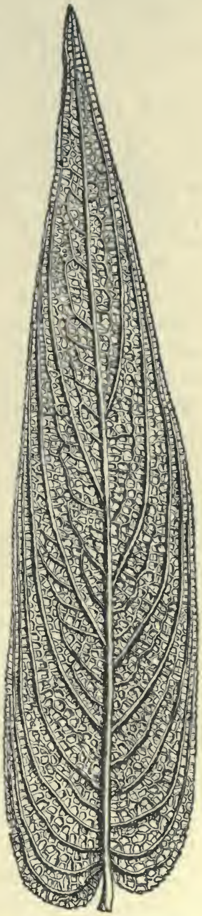


FIG. 80.—Matico: natural size.

2. *P. al'bum, White Pepper.*—The ripe fruit of *P. nigrum* deprived of the pericarp which it separates easily, and may be facilitated by

gathering spikes, cleaning, immersing in water, and rubbing with the hands in baskets. It is somewhat larger than the official, smooth, yellowish, hard, horny, mealy within; odor and taste similar to but less powerful than the *black.* There are four varieties: 1, Tellicherry; 2, Penang; 3, Batavia; 4, Singapore. Largely used in China. Still another variety is made by soaking off (or using mechanical means) the outer portion (pericarp) of black pepper, or simply drying the very young and immature fruit, but this is smaller and inferior. *Adulterations:* Same as in the official.

3. *P. angustifo'lium, Matico.*—The leaves, official 1860–1910; C. and S. America—Mexico, Cuba, Peru, Brazil, etc.; cultivated. Shrub 3 M. (10°) high, stem with enlarged joints and quadrangular branches, the younger hairy; flowers small, yellowish, dense spike; fruit size of a poppy seed, hard, black, 1-seeded. Leaves, 10–15 Cm. (4–6′) long, petiolate, oblong-lanceolate, apex pointed, base unequally cordate, crenulate, tessellated above, reticulated beneath, meshes small, veins densely brownish-hairy; aromatic, spicy, bitterish, astringent; solvents: alcohol (50–75 p. c.), boiling water; contains volatile oil 2–3 p. c., artanthic acid, pungent resin, bitter principle, tannin, mucilage—maticin is only a potassium salt. Stimulant, tonic, diuretic, styptic, vulnerary, aphrodisiac (similar to cubeb—mostly due to volatile oil); bronchitis, gonorrhœa, menorrhagia, hemorrhoids, diarrhœa, dysentery, hæmaturia, hemorrhage, vesical catarrh, incontinence of urine; locally to bleeding surfaces, owing to the many hairs promoting blood-clot. *Adulterations:* Leaves of allied species of its own genus, and those of *Eupato'rium* and *Walthe'ria* genera—none being tessellated above or rough and hairy beneath. Dose, gr. 15–60 (1–4 Gm.); fluidextract (75 p. c. alcohol), ♏xv–60 (1–4 Ml. (Cc.)); infusion, 5 p. c., ℥j–2 (30–60 Ml. (Cc.)).; tincture, 10 p. c., ʒj–2 (4–8 Ml. (Cc.)).

4. *P. Be'tel.*—India. Climbing plant; leaves chewed by the Malays with lime and areca-nut shavings. *P. Carpun'ya*, Chile, Peru; small tree. *P. pelta'tum, P. umbella'tum;* Tropical America. Diuretic, skin diseases, tumors.

5. *Methys'ticum Methysticum* (*Piper Methysticum*), *Ava* (*Kava-Kava*).—Sandwich Islands. Dried rhizome and roots; stimulant, diuretic, diaphoretic, tonic, has lilac odor, pungent, bitter taste; contains acrid resin 2 p. c., volatile oil, kavahin, methysticin (resembles piperine). Dose, gr. 15–30 (1–2 Gm.); fluidextract (60 p. c. alcohol); infusion yields upon fermentation the beverage *kava;* also used natively for vesical and urethral affections.

6. *Ju'glans cine'rea, Butternut.*—Juglandaceæ. The dried, inner root-bark, collected in autumn, official 1820–1900; N. America (Canada, United States). Handsome tree, 9–15 M. (30–50°) high, branched, deliquescent; leaves imparipinnate, 5–9 pairs of leaflets; flowers—staminate and pistillate; fruit large drupe, oblong, 6 Cm. (2⅖′) long, hairy, viscid, green then brown; seed or kernel thick, oily, edible. Root-bark (liber), in pieces, 5 Mm. (⅕′) thick, deprived of soft cork, deep brown, smoothish, striate, transverse fracture short, delicately checkered; this inner bark when first uncovered is pure white, but

upon exposure immediately becomes lemon color, finally deep brown; contains nucin (juglone, juglandic acid), fixed oil 14 p. c.,. volatile oil, resin, tannin. Resembles rhubarb, but does not gripe—cathartic, tonic, rubefacient; costiveness, dysentery, with calomel in intermittent and remittent fevers. Dose, ʒj–2 (4–8 Gm.); extract (alcohol), gr. 5–20 (.3–1.3 Gm.); fluidextract (glycerin 10, alc. 50, water 40); juglandin ("Eclectic" resinoid), gr. 3–10 (.2–.6 Gm.).

7. *J. re'gia, English Walnut.*—Persia, Himalayas, China, cultivated, Europe. Decoction of leaves used in leucorrhœa, meningitis; decoction of leaves, rind, or bark in checking mammary secretion, ulcers, diarrhœa, sore mouth, tonsils, uterine hemorrhages, carbuncles.

8. *J. ni'gra, Black Walnut.* — Bark styptic, acrid; used mostly in dyeing. The rind of green fruit removes ringworms, tetter, diphtheria. Decoction used as a vermifuge; spirit made by distilling fresh walnuts with alcohol; used in hysteric, cerebral, and pregnant vomiting. All of these fruits contain much fixed oil, which turns red with nitric acid, but brown with nitric and sulphuric acids.

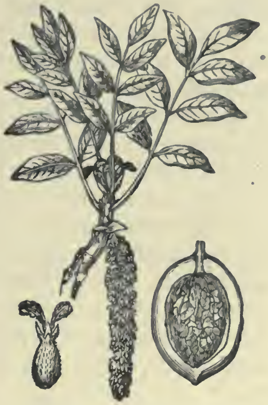


Fig. 81.—Juglans: flowering branch; cross-section of fruit.

15. SALICACEÆ. Willow Family.

Sal-i-ka'se-e. L. *Sali(x)c* + aceæ, willow, from Celtic *sal*, near, + *lis*, water—*i. e.*, its favored place of growth; or L. *salire*, to leap—its rapid growing. Trees, shrubs. Distinguished by light wood, bitter bark, alternate, stipulate leaves, diœcious flowers, both kinds in catkins, 1 to each bract, no perianth; fruit 1-celled, 2–4-valved pod, many-seeded, each with long silky hairs at one end, but covering it; ovary 1-celled, superior; stamens 2 or more; temperate climates; tonic, astringent, febrifuge, stimulant; timber, basket-making, seed hair for cushions.

Genera: **1. Salix. 2. Populus.**

SALIX. SALIX (WILLOW).

Salicinum. Salicin, $C_{13}H_{18}O_7$, *official.*

Salix and **Populus,** several species. } A glucoside.

Habitat. Europe, N. America; cultivated.

Syn. White Willow, Common European-, Duck-, Huntington-, Salicin Willow, Withe, Withy; Fr. Saule blanc, Salicine; Ger. Weidenrinde, Salicin.

Sa'lix. L. see etymology, above, of Salicaceæ.

Pop'u-lus. L. poplar, fr. *populus*, the people—being often planted along the public ways in Rome, where it was called *arbor populi*, tree of the people.

PLANTS.—These two juxta-positioned genera are composed mostly of large trees 15–18 M. (50–60°) high, with flexible branches: *Salix* leaves, long pointed, entire or glandularly toothed; *Populus* leaves, broad, more or less heart-shaped, ovate, toothed; flowers May, both in catkins appearing before the leaves, diœcious, buds covered with scales, or a varnish; barks of both genera resemble; that of *Salix* slips from the wood more readily.

CONSTITUENTS.—Salicin 1–3 p. c., tannin 12 p. c., extractive matter.

Salicinum. Salicin.—Obtained by several methods: 1. Add litharge or basic lead acetate to hot concentrated decoction of young bark to remove tannin, gum, extractive; the filtrate contains salicin and some absorbed lead, the latter is separated by adding sulphuric acid and barium sulphide, while salicin, upon concentration of the filtrate, crystallizes out. When basic lead acetate is used, the free acid should be neutralized with calcium carbonate, and then the filtrate evaporated. 2. Boil bark with milk of lime to remove tannin, evaporate filtrate to soft extract, digest this with alcohol, from which salicin will crystallize after distilling off the alcohol. It is in colorless, silky, shining, crystalline needles, rhombic prisms, white, crystalline powder, odorless, very bitter taste, soluble in water (23.5), hot water (3.3), alcohol (88.5), hot alcohol (30), insoluble in chloroform, ether; aqueous solution (1 in 30) neutral, lævorotatory, melts at 200° C. (392° F.). *Tests:* 1. Heat small portion in test-tube until brown, add distilled water (few Ml.; Cc.), + few drops of ferric chloride T. S.—violet color. 2. With sulphuric acid—red color, disappearing on adding distilled water; incinerate 2 Gm.—ash .05 p. c. 3. Heat gently .1 Gm. with potassium dichromate .2 Gm. + diluted sulphuric acid 2 Ml. (Cc.)—fragrant odor of salicylic aldehyde. *Impurities:* Heavy metals, alkaloids, salicylic acid. Should be kept in well-closed containers. Dose, gr. 10–30 (.6–2 Gm.).

FIG. 82. — Willow bark: transverse section, magnified 15 diam.

Commercial.—The *White Willow* (*Salix al'ba*) and *Crack Willow* (*S. frag'ilis*) contain most tannin, the *Purple Willow* (*S. purpu'rea*) most salicin, it being even in the leaves, although largest quantity in bark of young wood. *Populus al'ba, P. angustifo'lia, P. acumina'ta, P. trem'ula,* all yield salicin to a considerable extent.

PREPARATIONS.—(Unoff.): May give in powder, pill, syrup, water, or with licorice extract, in small and frequent doses.

PROPERTIES.—Bitter tonic, antiperiodic, antipyretic, antiseptic, antiferment. Its action is slower, weaker, and depresses heart less than salicylic acid; it is non-toxic, possibly circulates like salicylic acid in the blood as sodium salicylate, and is eliminated chiefly by the urine as salicylic, salicyluric, salicylous acids and saligenin, being first converted in the stomach into glucose and saligenin.

Uses.—Acute rheumatism, lower temperature in fevers; relieves pain, reduces arterial swellings, intermittents (not nearly so effective as quinine), coryza, hay fever, influenza, neuralgia, diabetes. Externally—gangrenous wounds, eczema, cancer, burns, fetid perspiration (applied in solution with borax).

Allied Plants:

1. *Populus ni'gra* or *P. balsamif'era, Populi Gemmæ, Balm of Gilead Buds.* The air-dried, closed winter leaf-buds, collected in early spring; about 2 Cm. ($\frac{4}{5}'$) long, 3 Mm. ($\frac{1}{8}'$) thick; imbricated scales, brown, glossy, glutinous (fragrant resin), balsamic, bitter. Stimulating expectorant; ointment for ulcers.

2. *Myri'ca cerif'era, Bayberry Bark* (root). Dose, gr. 5–15 (.3–1 Gm.); comp. powder (composition powder), 60 p. c., jamaica ginger 30, capsicum 5, clove 5; tonic, astringent, diuretic.

3. *Bet'ula len'ta, Sweet-, Spice-Birch.*—Betulaceæ. The volatile oil distilled from the bark, official 1890–1910; N. America (Newfoundland to Georgia, west), forests. Plant large tree, bark dark brown, sweet, aromatic, not separable into layers, but in spring exudes sweetish, edible juice; leaves ovate, acuminate, serrate, petiolate; flowers catkins, staminate, pistillate; wood reddish, strong, compact. Oil (natural oil of wintergreen) exists in plant as a glucoside, gaultherin, which must be hydrolized, by inherent ferment in the presence of water (macerating bark for 12 hours), into methyl salicylate and glucose, and then distilled; it is a colorless, yellowish liquid, characteristic aromatic odor, sweet, warm, aromatic taste, optically inactive, as is methyl salicylate, sp. gr. 1.187; consists of methyl salicylate, $CH_3C_7H_5O_3$, 99.8 p. c., triacontan (paraffin), $C_{30}H_{62}$, ester, $C_{14}H_{24}O_2$, but no alcohol as in oil of gaultheria. *Adulterations:* Methyl salicylate, alcohol, phenols, oil of turpentine, petroleum, etc. Properties, uses, poisoning same as oil of gaultheria. This bark and gaultheria leaves are distilled together indiscriminately in varying proportions for the volatile oil. Dose, ♏v–10 (.3–.6 Ml. (Cc.)), gradually increased. *B. al'ba.*—Asia, Europe, N. America (Can. to Penn.). The buds and twigs yield by distillation .33 p. c. of colorless volatile oil; the wood and bark (in layers) yield brown birch tar, having odor of Russia leather. When this tar is distilled we get *Oleum Betulæ Empyreumaticum Rectificatum* (*Oleum Rusci Rectificatum*). *B. papyrif'era, Paper* or *Canoe Birch* (*White Birch*)—Canada, New York. This has cordate leaves, tough white bark, splitting into papery layers. Used by the Indians in making canoes.

16. FAGACEÆ (CUPULIFERÆ). Beech Family.

Fa-ga'se-e. L. *Fag-us* + aceæ, fr. Gr. φαγεῖν, to eat, φαγός, the beech—*i. e.*, in allusion to the esculent nuts once used as food. Trees, shrubs. Distinguished by alternate irregular leaves; fruit in a bur or cupule—pistillate involucre; flowers monœcious, staminate, aments, stamens 5–20, pistillate, spikes 1–3, or scaly catkins, involucre; petals none; ovary inferior, 2–6-celled, ovules 1–2 in each cell; fruit 1-seeded nut; temperate climates, tropics; astringent, seed edible valuable timber.

Genus: **1. Quercus.**

GALLA. NUTGALL.

Quercus infectoria, *Olivier,* and allied species. { Excrescences on the young twigs, induced by punctures (stings) on the leaf-buds and by the deposited ova of *Cynips tinctoria, Hartig.*

Habitat. Mediterranean Basin, eastward; Greece, Persia, Asia Minor, Syria.

Syn. Gall, Aleppo Galls, Smyrna Galls, Turkey or Mecca Galls, Galls, Oak Warts, Mad-, Oak-, or Dead Sea-Apple, Apple of Sodom, Dyers' Oak, Galla Halepense-, Turcica-, Levantica-, Tinctoria-, Quercina; Fr. Galle d'Alep—de Chêne, Noix de Galle; Ger. Gallæ, Galläpfel, Gallen.

Quer'cus. L. oak, fr. Celtic *quer*, fine + *cuez*, a tree—fine, stately tree; or fr. Gr. *χοῖρος*, a pig—*i. e.*, pigs love and feed on the acorns.

In-fec-to'ri-a. L. *infectorius*, dyeing, staining; *in*, in + *facere*, to do, make, taint—*i. e.*, species easily infected or stung, thereby yielding dyeing product.

Gal'la. L. for *gall*, fr. Eng. *gallen*, galled = chafed, as a horse, or from its gallish taste.

PLANT.—Polymorphous shrub, 1.3–2 M. (4–6°) high; leaves obovate, shallow rounded lobed, 5–7.5 Cm. (2–3′) long; flowers May, catkins; fruit Sept., acorn, 2.5–4 Cm. (1–1$\frac{3}{5}$′) long. EXCRESENCES (nutgall) subglobular, 1–2 Cm. ($\frac{2}{5}$–$\frac{4}{5}$′) broad, upper portion tuberculated, basal portion nearly smooth and contracted into a short stalk, olive-green, blackish-gray; heavy, sinking in water (excepting the smaller, of which there should be not more than 5 p. c.); fracture short-horny; internally grayish, centre radiating and resinous, occasionally hollow and traversed by a narrow radial canal to the exterior; stone cells outside of cavity, parenchyma containing tannin more exteriorly; odor slight; taste strongly astringent. POWDER, grayish-yellow; microscopically —numerous fragments of starch-bearing parenchyma, starch grains .005–.03 Mm. ($\frac{1}{5000}$–$\frac{1}{800}$′) broad, few stone cells resembling those in fruits and seeds, tracheæ. *Tests:* 1. Fragments mounted in dilute ferric chloride T. S.—deep blue, greenish-blue (tannin). 2. Macerate for a few minutes .5 Gm. in alcohol 2 Ml. (Cc.), + water 50 Ml. (Cc.), stir 5 minutes; 1 Ml. (Cc.) of yellowish filtrate + water 10 Ml. (Cc.) + a drop of ferric chloride T. S.—blue, violet-blue. *Solvents:* alcohol; water. Dose, gr. 5–30 (.3–2 Gm.).

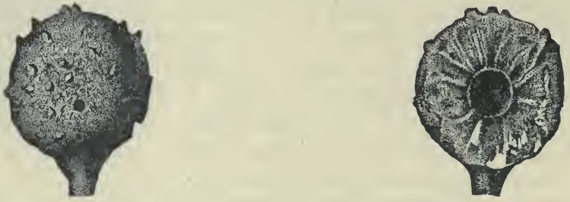


FIG. 83.—Galla: *a*, entire; *b*, vertical section.

Commercial.—Plant differs from the once official *Q. alba*, in seldom being tree-like, less indented leaves, larger acorns, and dissimilar cupules. The leaf-buds and tender bark of shoots are stung (punctured) easily by the horny evipositors of the female hymenopterous insects which deposit one or more eggs in such galled places (wounds), and thereby establishes morbid growth that quickly leads to the formation of a small tumor of hypertrophied tissue enclosing the egg; upon the gall reaching full development the egg hatches into a larva or grub that at once begins feeding on juices of the central cavity, which, never larger than the larva, soon becomes lined with a wall of hard cells that gradually extend to the periphery, causing the gall to harden. The grub when grown passes into the pupa (chrysalis) stage, thence into a 4-winged fly, 6 Mm. ($\frac{1}{4}'$) long, that must either die or cut itself out with its mandibles, thus making a small round opening midway the gall; should this not be accomplished the insect remains will be revealed upon cracking open the unpunctured gall. Color is the guide to quality —the whitish, light, and spongy being rejected. There are several varieties: 1, *Aleppo* (*Syrian*), best, bluish, usually collected before the fly escapes; 2, *Smyrna*, grayish-olive, intermixed with white galls (least valuable, generally with large perforation); 3, *Sorian*, blackish, size of a pea; all three varieties exported from Trebizond, Smyrna, Bassora, Calcutta, Bombay; 4, *European;* light-color, more spongy, produced by a different cynips; much tannin; 5, *American:* (*a*) *Q. alba*, light, spongy; little tannin; (*b*) *Q. virginiana* (*virens*), Texas—resembles Aleppo but not tuberculated; tannin 40 p. c.; (*c*) *Q. lobata*, California, 5 Cm. (2′) broad, orange-brown, glossy, soft, spongy interior; much tannin.

CONSTITUENTS.—Tannin 50–60 p. c. (white galls 20–30 p. c.), Gallic acid 2–3 p. c., mucilage, sugar, fat, resin; in the nucleus starch.

Acidum Tannicum. Tannic Acid, $HC_{14}H_9O_9$, *official.*—(Syn., Acid. Tann., Gallo-tannic Acid, Tannin, Digallic Acid; Fr. Tannin officinal, Acide tannique; Ger. Gerbsäure.) Obtained by exhausting powdered nutgall with warm water, cooling, agitating the filtrate with one-fourth volume of ether; the emulsion separates in 10 days, yielding an upper ethereal layer (coloring matter, fat, resin, gallic and ellagic acids), which is discarded, and a lower aqueous fluid, containing tannin, which under reduced pressure, is concentrated in a still to syrupy consistence, cooled, and spread on thin glass plates to dry—these being placed on a steam table and covered over to produce puffy, spongy character. It is a yellowish-white, light brown amorphous powder, darker on exposure to air and light, usually cohering as glistening scales, spongy masses; odorless, faint characteristic odor; strongly astringent taste, acid reaction; soluble in water, alcohol, diluted alcohol, slightly in dehydrated alcohol, glycerin (1) heated, almost insoluble in ether, chloroform, benzene, petroleum benzin; owing to weak combination with variable proportions of glucose once considered a glucoside. *Tests:* 1. Aqueous solution + ferric chloride—bluish-black color or precipitate. 2. Aqueous solution precipitates nearly all alkaloids, glucosides, solutions of gelatin, albumin, starch (dist. from gallic acid). 3. On drying—loses 12 p. c.; incinerate 1 Gm.—ash .6 p. c. *Impurities:* Gum, dextrin, resinous substances. *Incompatibles:* Alkalies, alkaloids, emulsions, gelatin, ferric salts, mineral acids, salts of antimony, lead and silver. Should be kept cool, dark, in well-closed containers. Dose, gr. 1–20 (.06–1.3 Gm.).

Acidum Gallicum. Gallic Acid, $HC_7H_5O_5 + H_2O$, *official.*—(Syn., Acid. Gallic., Trihydroxybenzoic acid, Dihydroxysalicylic acid; Fr. Acide gallique; Ger. Gallussäure.) This organic acid usually is prepared from tannic acid by boiling 15 minutes 1 part (or 2 parts nutgall) with sulphuric acid (1) and water (5); strain while hot, set aside for crystallization; a once popular method consisted in exposing to the air a mixture of nutgall and distilled water in a thin paste for a month, adding water occasionally to keep semi-fluid, expressing, rejecting liquid, boiling residue with distilled water, filtering hot through animal charcoal, setting aside to crystallize. It is in white, pale fawn-colored, silky, interlaced needles or triclinic prisms; odorless; astringent, slightly acidulous taste; permanent, soluble in water (87), boiling water (3), alcohol (4.6), glycerin (10), ether (100), almost insoluble in chloroform; on drying loses 12 p. c.; saturated aqueous solution—acid; incinerate 1 Gm.—ash .1 p. c. *Tests:* 1. Neutralize saturated aqueous solution with few drops of sodium hydroxide T. S.—gradually a deep green, changing to reddish by acids. 2. With ferrous solutions—neither colors nor precipitates; with ferric solutions—bluish-black precipitate. 3. Cold, saturated aqueous solution with alkaloids, glucosides, albumin, gelatin T. S., starch T. S.—no precipitate (abs. of tannic acid). It is the hydride of tannic acid, the latter being the anhydride of gallic acid, a relationship and convertibility shown by the equations: (1) $2HC_7H_5O_5—H_2O = HC_{14}H_9O_9$. (2) $HC_{14}H_9O_9 + H_2O = 2HC_7H_5O_5$. *Impurities:* Tannic acid, etc. *Incompatibles:* Ferric and metallic salts, spirit of nitrous ether. Dose, gr. 5–20 (.3–1.3 Gm.).

PREPARATIONS.—I. NUTGALL. 1. *Unguentum Gallæ.* Nutgall Ointment. (Syn., Ung. Gall., Ointment of Galls; Fr. Pommade de Noix de Galle; Ger. Galläpfelsalbe.)

Manufacture: 20 p. c. Rub nutgall 20 Gm. with ointment 80 Gm., gradually added, until thoroughly mixed, avoiding metallic utensils; externally.

Unoff. Preps.: Fluidextract, dose, ♏v–30 (.3–2 Ml. (Cc.)). *Infusion,* 5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)). *Tincture,* 20 p. c. (alcohol 90, glycerin 10), dose, ʒss–2 (2–8 Ml. (Cc.)). *Unguentum Gallæ cum Opii* (Br., nutgall 18 p. c. + opium 7.5 p. c.).

II. TANNIC ACID.—1. *Glyceritum Acidi Tannici.* Glycerite of Tannic Acid. (Syn., Glycer. Acid. Tann., Glycerite of Tannin; Fr. Glycéré de Tannin, Glycérine tannique; Ger. Tanninglycerit (glycerol.)

Manufacture: 20 p. c. Add, in small successive portions, tannic acid 20 Gm. to hot glycerin 80 Gm., agitate until dissolved, strain through purified cotton. Dose, ♏x–30 (.06–2 Ml. (Cc.)); externally.

2. *Trochisci Acidi Tannici.* Troches of Tannic Acid. (Syn., Troch. Acid. Tann.; Fr. Tablettes (Pastilles) de Tannin; Ger. Tanninpastillen.)

Manufacture: Rub together until thoroughly mixed tannic acid 6 Gm., sugar 65 Gm., tragacanth 2 Gm., form mass with stronger orange flower water q. s., divide into 100 troches. Dose, 1–3 troches.

3. *Unguentum Acidi Tannici.* Ointment of Tannic Acid. (Syn., Ung. Acid. Tann.; Fr. Pommade de Tannin; Ger. Tanninsalbe.)

Manufacture: 20 p. c. Dissolve tannic acid 20 Gm. in glycerin 20 Gm., with gentle heat, mix thoroughly with ointment 60 Gm., avoiding iron utensils.

Unoff. Preps.: Collodium Stypticum, tannic acid 20 Gm., flexible collodion 80. *Suppositoria Acidi Tannici* (Br., each 3 gr.; .2 Gm.).

III. Gallic Acid.—1. *Pyrogallol. Pyrogallol,* $C_6H_3(OH)_3$. (Syn., Pyrogall., Pyrogallic Acid, Acidum Pyrogallicum; Fr. Acide pyrogallique; Ger. Pyrogallolum, Pyrogallussäure.) Trihydroxybenzene (triatomic phenol) is obtained by heating gallic acid for half an hour under pressure with water (3), boiling with animal charcoal, filtering, evaporating—$HC_7H_5O_5 + \text{heat} = C_6H_5(OH)_3 + CO_2$; yield 75 p. c. It is in light, white, nearly white laminæ, fine needles, odorless, bitter taste, acquiring grayish tint on exposure, soluble in water (1.7), alcohol (1.3), ether (1.6), melts at 131° C. (268° F.). *Tests:* 1. Aqueous solution (1 in 10) reduces solutions of silver, gold and mercury salts, even in the cold; incinerate 1 Gm.—ash .1 p. c. 2. Aqueous solution (1 in 20) neutral, slightly acid, colorless, yellowish, brown on exposure from absorbing oxygen; with a few drops of ferric chloride T. S.—brownish-red; with fresh ferrous sulphate T. S.—blue color. Should be kept dark, in well-closed containers.

Properties.—I. Nutgall: Astringent, tonic; constringes muscular tissue, thus checking secretions, hemorrhages, local inflammations, etc.

II. Tannic Acid: Local astringent. Internally—contracts blood-vessels, restrains peristalsis (constipates), coagulates mucous secretions, prevents secretion of gastric and intestinal juices, precipitates pepsin, etc.; it is converted into gallic acid in the intestines, and until this change is effected it cannot become absorbed to act as a remote or systemic astringent, simply being able to control locally gastric and intestinal bleeding. Externally—astringent, coagulates blood (forming a clot), albumin, and gelatin (tans tissues), is hæmostatic, antiseptic, depressant, irritant; the salts have no astringency.

III. Gallic Acid: Mild astringent, does not coagulate blood, hence recognized only as remote astringent, but not to raw and bleeding surfaces; internally—controls systemic hemorrhages (contracts blood-vessels), decreases secretion of urine and sweat; does not constipate like tannic acid, and is eliminated by the kidneys unchanged.

Uses.—I. Nutgall: Chronic diarrhœa, dysentery, gleet, leucorrhœa, antidote to tartar emetic and alkaloids (emetine, morphine, colchicine, strychnine, etc.), constringes the stomach, thus delaying absorption, forming of the alkaloids insoluble tannates. In cases of poisoning give infusion freely. Locally infusion as gargle for relaxed mucous membrane of mouth, throat, vagina, rectum; ointment with 5–10 p. c. opium, good in hemorrhoids after inflammatory stage. Chiefly used for obtaining tannic and gallic acids, for ink, dyeing, tanning.

II. Tannic Acid: Hemorrhages (epistaxis, uterine, etc.), diarrhœa, dyspepsia, cholera, relaxed uvula, coryza, inflamed fauces, diphtheria, toothache, aphthæ, excessive salivation, leucorrhœa, chapped nipples, gleet, gonorrhœa, ulcers, piles, chilblains, chronic bronchitis, whooping-cough, phthisis, influenza, ozæna, fissures, hemorrhoids, prolapsus ani and uteri, vesical catarrh, hemorrhage after extracting teeth, spongy gums (contracts vessels, checks absorption, hence loosening of teeth), obtunds sensitive dentine, either alone or combined with morphine and creosote, to toughen mucous membranes, skin around nipples, conjunctivitis, erectile tumors, ingrowing toe-nails; aqueous solutions (1 to 50) may be injected into urethra and bladder, but should never be used hypodermically.

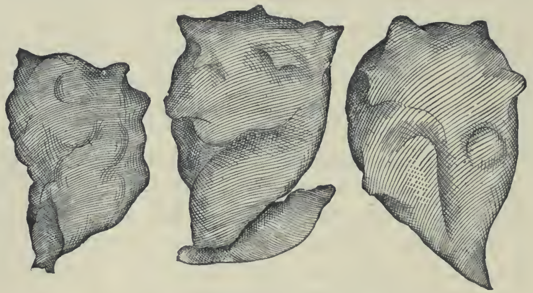


Fig. 84.—Chinese nutgalls.

III. Gallic Acid: Menorrhagia, purpura, epistaxis, hæmoptysis, hæmatemesis, hemorrhage of stomach, intestines, lungs, kidneys, night-sweats, polyuria, Bright's disease, dyspepsia, bronchitis, hemorrhoids, chronic ulcers, pyrosis, alopecia.

IV. Pyrogallol: Psoriasis, syphilitic ulcers, lupus, epithelioma, parasiticide for ringworm. Should not be applied over extensive surface, as absorption may poison; not used internally; ointment 1–5–10 p. c.

Allied Products:

1. *Chinese Nutgalls* (*Rhus semiala'ta*) by sting of *A'phis' s(ch)inen'sis.* —Galls 4–5 Cm. (1⅗–2′) long, ovate, irregular, tuberculate, grayish-downy, hollow; shell thin, fragile, containing many insect-remains.

2. *Japanese Nutgalls* (*R. semialata* or *R. japon'ica*) resemble Chinese. —The tannic acid of these differs from that of official galls.

3. *Vallonea, Acorn Cups* of many *Quercus* species (*Q. Robur, Q. Vallo'nea, Q. Æ'gilops*), 2.5 Cm. (1′) in diameter, with thick, spreading scales, strongly astringent taste, largely used in tanning.

4. *Tamarisk Galls* (*Tam'arix articula'ta* (*orienta'lis*), *T. africa'na. T. gal'lica*).—Asia, Africa, 3–12 Mm. (⅛–½′) thick, subglobular, knotty, contain tannin 40–50 p. c.

5. *American Nutgalls* (*Q. alba, Q. virginiana* (*virens*), *Q. lobata*). first poor in tannin; second (Texas) like Aleppo, but not tuberculate, tannin 40 p. c.; third (California), 5 Cm. (2′) thick, glossy, orange-brown, rich in tannin.

Allied Plants:

1. *Quer'cus al'ba, Quercus, White* (*Tanner's*) *Oak.*—The dried bark, collected from trunks or branches 12–25 years of age, deprived of

periderm, official 1820–1910; N. America. Stately tree 18–25 M. (60–80°) high, 1–2.5 M. (3–8°) thick, branched; leaves large, 4–6-lobed, petiolate, smooth, light green, glaucous with prominent veins beneath, brownish when dry; flowers monœcious—staminate, catkins; pistillate, followed by 1-seeded ovoid fruit (nut, acorn), base in cupule. Bark, flat pieces, 2–10 Mm. ($\frac{1}{12}$–$\frac{2}{5}$′) thick, light brown, rough-fibrous, fracture uneven, coarsely fibrous; odor distinct; taste strongly astringent; does not tinge saliva yellow when chewed; solvents: alcohol, water; contains tannin 6–11 p. c., oak-red, quercin, resin, fat, quercite. Astringent, tonic, hæmostatic, similar to tannin; diarrhœa, dysentery, cholera infantum, hæmoptysis, hemorrhages, leucorrhœa, gonorrhœa, intermittents, phthisis, relaxed parts, ulcers; gargle—prolapsed uvula, etc.; poultice—gangrene, etc.; powder—tooth powders and washes; tanning leather; wood durable, valuable. Dose, gr. 15–60 (1–4 Gm.); decoction, 5 p. c., ʒss–1 (15–30 Ml. (Cc.)); extract, gr. 2–10 (.2–.6 Gm.); fluidextract (alcohol 50, water 40, glycerin 10), ♏xv–60 (1–4 Ml. (Cc.)).

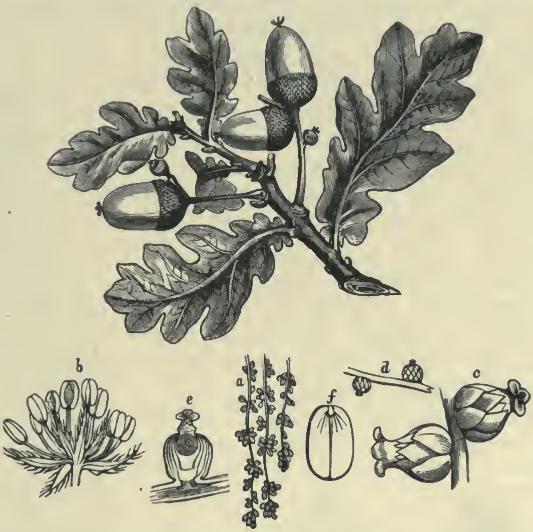


FIG. 85.—*Quercus alba:* *a*, staminate catkins; *b*, magnified staminate flower; *c*, pistillate flower with stigmas magnified; *d*, acorn in embryo; *e*, section of young acorn; *f*, cotyledon with radicle.

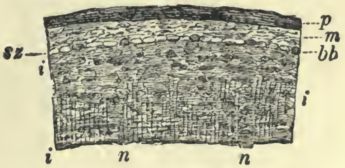


FIG. 86.—*Quercus alba:* bark, cross-section, magnified 10 diam.; *p*, cork; *m*, outer bark; *i*, inner bark; *sz*, group of stone cells; *bb*, bast-fibre; *n*, longitudinal fibre.

2. *Q. veluti'na* (*coccin'ea* var. *tincto'ria*), *Black* (*Scarlet*) *Oak* (*Quercitron*).—The (inner) bark, official 1820–1880. Trees 24–30 M.

(80–100°) high, 1–1.2 M. (3–4°) thick, leaves oblong, lobed, 15–20 Cm. (6–8′) long, mucronate; fruit, acorns, 12–18 Mm. ($\frac{1}{2}$–$\frac{3}{4}$′) long, 12 Mm. ($\frac{1}{2}$′) thick, cupule thick, shallow; bark resembles the preceding, only reddish-brown, gives saliva brownish-yellow color; contains tannin 6–12 p. c., quercitrin (red-brown coloring matter, dyeing yellow wool, silks, etc.), $C_{36}H_{38}O_{20}$, with diluted acids yields isodulcite, $C_6H_{14}O_6$, and yellow quercetin, $C_{24}H_{16}O_{11}$. In the South barks of *Q. nigra* and *Q. digitata* (*falcata*), used for this, although these have a much coarser texture and a deep reddish-brown color.

3. *Q. Ro'bur, Common European* or *English Oak.*—Tall tree, 24–30 M. (80–100°) high, having 3 forms: (*a*) *Q. pubes'cens* (old leaves hairy); (*b*) *Q. peduncula'ta* (leaves smooth, pistillate flowers, and fruit on peduncles; (*c*) *Q. sessiliflo'ra* (leaves smooth, flowers and fruit sessile, petioles long). These have many varieties, all resembling *Q. alba.*

4. *Q. digita'ta* (*falca'ta*, L. *falcatus — i. e.*, leaf-lobes scythe-shaped), *Spanish* or *Red Spanish Oak.*—Maryland, Florida. Tree 18–21 M. (60–70°) high, leaves grayish, 3–5-lobed, finger- or scythe-shaped. Bark rich in tannin, wood reddish, coarse-grained; used in tanning, sometimes called quercitron.

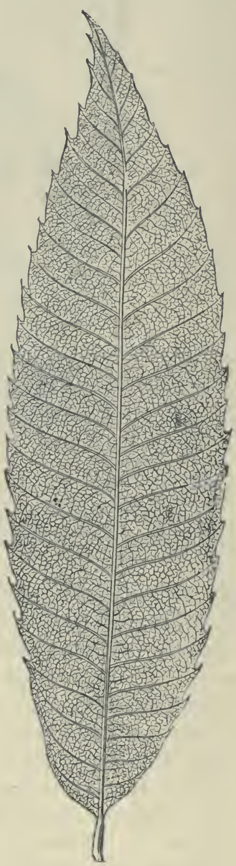


FIG. 88.—Castanea: leaf, one-half natural size.

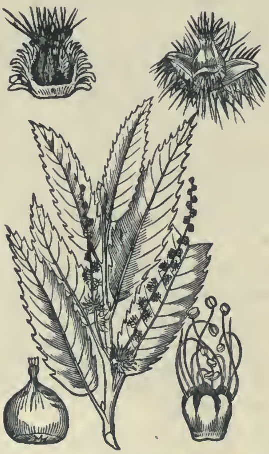


FIG. 87.—*Castanea dentata.*

5. *Q. marylan'dica* (*ni'gra, ferrugin'ea*), *Black, Barren,* or *Iron Oak* (*Black Jack*).—Southern States. Tree 9–12 M. (30–40°) high, leaves cuneate, 3–5-lobed, rusty, pubescent beneath, shining above. Of little value.

6. *Q. virginia'na* (*vi'rens*, L. *vireo*, green, fresh, flourishing), *Live Oak*.—Maryland, Florida. Tree 12–18 M. (40–60°) high. Bark rich in tannin, wood fine-grained; used in shipbuilding.

7. *Q. su'ber*, *Cork Oak*, *Alcornoque* (*Savanna Bark*).—Mediterranean Basin, S. United States. Small tree, 9–15 M. (30–50°) high, leaves toothed, ovate; bark with an elastic suberous layer 2.5–5 Cm. (1–2′) thick, collected every 8–10 years, and constitutes our cork of commerce. When finely powdered, sold as suberin for absorbent purposes, which name is applied to one of its constituents (fat). There are about 80 species of *Quercus*, ranging from shrubs to trees; one-half of these grow in the United States, and may, with their acorns, be used similarly. Acorns sometimes are roasted = *semen quercus tostum*, and used as a substitute for coffee; contain fixed oil, starch, citric acid, uncrystallized and quercite sugars.

8. *Casta'nea denta'ta*, *Chestnut*.—The dried leaves, collected Sept.–Oct., while still green, official 1870–1900; N. America, W. Asia, S. Europe. Stately tree, 24–30 M. (80–100°) high; wood light, durable; flowers in 3's, monœcious—staminate and pistillate, involucre 4-lobed, becoming prickly; fruit, 4-valved involucre enclosing 1–3 1-seeded nuts. Leaves 15–25 Cm. (6–10′) long, 5 Cm. (2′) wide, lanceolate, acuminate, mucronate, petiolate, feather-veined, sinuate-serrate, dark green above, smooth, odor slight; taste astringent; contains tannin 9 p. c., resin, fat, gum, albumin, ash 6 p. c.; fruit contains starch 35 p. c., fat 2 p. c., proteids 3–4 p. c., sugar 1–2 p. c.; solvents: boiling water, alcohol partially. Tonic, mild sedative, astringent; whooping-cough, controlling paroxysms, dysentery; wood resists exposure greatly, nuts a delicacy, thoroughly edible. Dose, gr. 15–60 (1–4 Gm.); fluidextract, ♏xv–60 (1–4 Ml. (Cc.)).

9. *C.* (*Fagus*) *pu'mila*, *Castanea* (*Chinquapin*).—The bark, official 1820–1860; Delaware-Mississippi. Shrub or small tree, 6–15 M. (20–50°) high, 25–37.5 Cm. (10–15′) thick, largest being South; leaves differ from chestnut in having underside white, downy; bark grayish, brownish inside; fruit rounded, conical, 12 Mm. ($\frac{1}{2}$′) long, 9 Mm. ($\frac{3}{8}$′) broad at base, same constituents and taste as chestnuts; bark contains tannin, resin, extractive. Used as tonic, astringent for intermittents.

10. *Fa'gus america'na* (*ferrugin'ea*), *American Beech*.—Tree, 22.5–30 M. (75–100°) high; bark and leaves used, the latter oblong-ovate, taper pointed, dentate, petioles and midrib soon (nearly) naked, prickles of fruit recurved or spreading; astringent, tonic.

17. ULMACEÆ. Elm Family.

Ul-ma'se-e. *Ulm-us* + aceæ, fr. Saxon *elm* or *ulm*—*i. e.*, its original name in all Celtic dialects. Trees, shrubs. Distinguished by leaves alternate, serrate, stipulate; sap not milky; flowers small, 3–9-parted or sepals; petals none, stamens 3–9; ovary 1-celled, superior; fruit 1-seeded, samara, drupe or nut; universal; demulcent, nutritive, astringent, tonic, timber.

Genus: **1. Ulmus.**

ULMUS. ELM.

Ulmus fulva, *Michaux.* } The bark deprived of the outer corky layer and dried.

Habitat. N. America, New England, S. Carolina, west to Louisiana, Nebraska.
Syn. Elm Bark, Slippery Elm, Moose-, Red-, Indian-, Sweet-, Rock or American Elm; British Tea (the leaves), Cortex Ulmi Interior; Fr. Écorce d'Orme (fauve); Ger. Ulmenrinde, Rüsterrinde.
Ul′mus. L. see etymology, page 157, of Ulmaceæ.
Ful′va. L. *fulvus*, deep yellow, tawny—*i. e.*, the color of the liber bark.

Plant.—Large tree, 15–18 M. (50–60°) high, .3–.6 M. (1–2°) thick; bark and wood reddish-brown, branches rough, whitish; leaves large 10–20 Cm. (4–8′) long, 5–7.5 Cm. (2–3′) broad, oblong, acuminate, unequal at subcordate base, unequally serrate, pubescent; rough on both sides, petiolate, buds covered with dense russet down; flowers April, small, appearing before leaves, sessile, in clusters, calyx downy, corolla wanting; fruit samara, 12–18 Mm. ($\frac{1}{2}$–$\frac{3}{4}$′) long, flat, broadly oblong, entire, notched, 1-celled, wing yellow, silky with short fulvous hairs. Bark (inner) usually in bundles of flat, oblong pieces about 30 Cm. (12′) long, 10–15 Cm. (4–6′) broad, light brown (buff), with occasional dark brown patches of adhering cork, longitudinally striate, and with detachable bundles of bast-fibres colored blackish by diluted iodine T. S.; inner surface light yellowish-brown, nearly smooth, finely striate, only slightly darkened by diluted iodine T. S.; fracture fibrous with projecting bast-fibres, broken surface porous from large mucilage cells; odor distinct; taste mucilaginous. Powder, light brown (fawn); microscopically—fibrous fragments, granular portion starch grains, .003–.025 Mm. ($\frac{1}{8325}$–$\frac{1}{1000}$′) broad, long bast-fibres, prisms of calcium oxalate, fragments of large mucilage cells with adhering starch grains. *Test:* 1. Macerate for 1 hour 1 Gm. in distilled water 40 Ml. (Cc.), forcibly strain—solution of a mucilaginous consistence. *Solvent:* water. Dose, ℥ij–4 (8–15 Gm.).

Adulterations.—Bark: Barks that are more brittle, less fibrous and mucilaginous; Powder: Corn meal, flour, starches.

Commercial: Tree flourishes in open high places, firm dry soil, being distinguished from *U. americana* by character of branches (rougher), leaves, buds, flowers, seeds. Bark should be collected in spring, deprived of epidermis, and dried, for which trees are felled in Michigan and other Western States, peeled and wood burnt or allowed to decay.

Constituents.—Mucilage, starch; European bark also contains tannin and bitter principle, but no starch.

Mucilage.—Resembles that of flaxseed—precipitated by lead acetate, but alcohol separates from its solution a gelatinous liquid.

Preparations.—(Unoff.): *Mucilage,* 6 p. c. (if to be free from starch must use cold water); dose, *ad libitum.* *Poultice.* *Uterine tents.*

Properties.—Demulcent, emollient, nutritive.

Uses.—Dysentery, diarrhœa, diseases of urinary passages, bronchitis. Externally—finely ground or powdered bark mixed with hot water into pasty mass and used as a poultice for inflammations, boils, etc.; in shape of tents to dilate fistulæ, strictures, os uteri, also in form of vaginal and rectal suppositories.

Allied Plants:

1. *Ulmus campes'tris.*—Europe. Bark thinner than official, cinnamon color, mucilaginous, bitterish, astringent. *U. effu'sa, Black Elm,* bark very similar; *U. america'na, White Elm,* New England, chiefly shade tree; *U. ala'ta, Wahoo,* S. United States. Bark used in making ropes.

18. MORACEÆ. Mulberry Family.

Mo-ra'se-e. L. *Mor-us* + aceæ, fr. Celtic *mor,* black—*i. e.,* alluding to the fruit's color. Trees, shrubs, herbs. Distinguished by leaves alternate or opposite, stipulate; sap milky; flowers monœcious or diœcious; calyx 4–5-parted, petals none, staminate panicled, pistillate capitate, cymose; ovary superior, 1-celled, ovule solitary; fruit various; universal; narcotic, sedative, tonic, astringent, fibres.

Genera: **1. Humulus. 2. Cannabis.**

HUMULUS. HOPS.

Humulus Lupulus, *Linné.* { The carefully dried strobiles, bearing their glandular trichomes, with not more than 2 p. c. of stems, leaves, foreign matter.

Habitat. N. Temperate zone, in hedges, thickets; cultivated in N. America (New England, N. Y., Mich.), Europe (England, Germany), C. Asia, Brazil, Australia.

Syn. Humul., Lupulus, Strobili (Humuli) Lupuli, Hop, Hop Vine, Bine, Bur, Seeder; Fr. Houblon; Ger. Hopfen.

Hu'mu-lus. L. *humus,* the ground—*i. e.,* the plant creeps on the ground unless supported.

Lu'pu-lus. L. dim. of *lupus,* a wolf—*i. e.,* it is wolfish, because it strangles the shrubbery upon which it climbs.

Hops, OE. *hoppen,* to climb—*i. e.,* plant leaps or hops from one place or support to another.

Plant.—Perennial, herbaceous twiner; root large, thick, branched; stems several, 6 M. (20°) long, striated, angular, rough, flexible, entwining left to right; leaves 7.5–10 Cm. (3–4′) long, cordate, 3–5-palmate-lobed, petiolate, scabrous with minute prickles, stipulate, dark green; flowers July–August, diœcious, axillary, the staminate yellowish-white racemes, pistillate densely leafy, pale green, cone-like spikes which produce the fruit (strobile). Strobiles, ovoid-cylindrical, 3 Cm. (1⅕′) long, consisting of narrow, hairy, flexuous rachis and, numerous, imbricated, yellowish-green, pale brown, obliquely-ovate, membranous scales, the base of each with numerous, yellowish-brown glandular hairs, frequently infolded on one side, enclosing a subglobular, light brown, very glandular achene; odor strong, characteristic, becoming disagreeable, valerian-like on aging; taste aromatic, bitter. Should be kept dark, in tightly-closed containers, and not used after a year old. *Solvents:* diluted alcohol; boiling water. Dose, ʒss–1 (2–4 Gm.).

Commercial: Hops ripen in September, being picked, dried carefully in kilns, not exceeding 70° C. (158° F.), packed in hempen bales or bags, and sent into market. If of good color and aroma are sold usually in bulk for brewing and the drug trade, while those deficient in lupulin (by abrasion, shaking), of off-color (brown by age and exposure), or of rankish odor (valeric acid), hence inferior, are compressed tightly into varying-sized rectangular cakes; or they may be bleached by sulphur dioxide, thereby retarding oxidation, and bartered loosely; or may be sprinkled with alcohol before pressing (developing special odors and preventing that of valeric acid) when they should be aired at least a month prior to use in medicine or beer. Manufacturers of the beverages will not accept such knowingly, but this seems without valid reason.

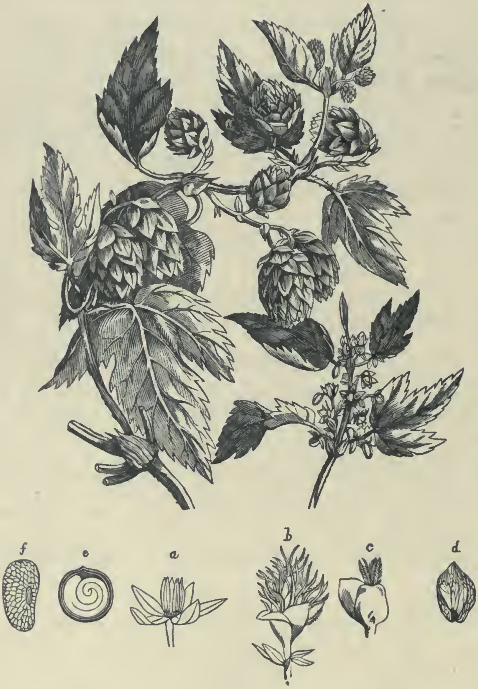


FIG. 89.—*Humulus Lupulus: a*, staminate flower; *b*, pistillate flower; *c*, sepal; *d*, bract; *e*, embryo; *f*, lupulinic gland (lupulin).

CONSTITUENTS.—Volatile oil .8 p. c., Choline (lupuline), resin (3) 9–18 p. c., trimethylamine, asparagin 1 p. c., tannin (lupulo- or humulotannic acid), $C_{25}H_{24}O_{13}$, 4 p. c., phlobaphene (decomposition product from the tannin; dark red, with acids yielding glucose and hop-red), $C_{50}H_{46}O_{25}$, wax, pectin, diastase (?), sugar, phosphates, nitrates, malates, citrates, ash 7–10 p. c. (K,Ca,Si,+).

Volatile Oil.—Obtained by distillation; brownish, aromatic, non-bitter; contains chiefly sesquiterpene (humulene), also some terpene; sp. gr. 0.865, soluble in alcohol, ether, chloroform, oxidizing into valeric acid.

Choline.—Possibly from decomposition of lecithin; volatile liquid alkaloid with coniine-like odor, alkaline, non-bitter, upon boiling yields trimethylamine.

PREPARATIONS.—(Unoff.): *Elixir*, 12.5 p. c. (fldext.). *Extract*, dose, gr. 3–10 (.2–.6 Gm.). *Fluidextract* (60 p. c. alcohol), dose, ♏xv–60 (1–4 Ml. (Cc.)). *Infusum Lupuli*, 5 p. c., dose, ℥j–4 (30–120 Ml. (Cc.)). *Tincture*, 20 p. c. (dil. alc.), dose, ʒj–2 (4–8 Ml. (Cc.)). *Poultice.*

PROPERTIES.—Tonic, sedative, anodyne, hypnotic. Somewhat diaphoretic, astringent, anaphrodisiac, diuretic, stomachic, carminative. Increases heart action, skin circulation; after slight cerebral excitement have calm, soporific effect. Tonic property due to bitter principle—lupamaric (lupulinic) acid; stimulant then sedative, due to volatile oil. Aromatic and bitter virtues reside mostly in the glands (lupulin).

USES.—Dyspepsia, delirium tremens, priapism, seminal emissions, incontinence of urine, irritable bladder. Externally—rheumatism, abscesses, spasms, colic, toothache, bruises; for these, use poultice made by moistening hops with hot water, vinegar, alcohol or laudanum, enclosing in porous cloth and applying while hot to painful part. Tincture with tincture of capsicum good following a debauch as a substitute for alcoholic drinks.

Derivative Product:

1. *Lupulinum, Lupulin.* The glandular trichomes separated from the fruit of *Humulus Lupulus*, official 1830–1910. Obtained by handling, thrashing dried strobiles, or picking off scales, shaking and rubbing glands through fine sieve; yield 8–16 p. c. It is in minute granules, bright brownish-yellow mass, becoming yellowish-brown and resinous, inflammable; under microscope globular, ellipsoidal, .1–.3 Mm. ($\frac{1}{250}$–$\frac{1}{80}{}'$) broad, reticulate, multicellular; odor and taste characteristic of hops. *Tests:* 1. Agitate with water—no sediment on standing (abs. of sand, etc.). 2. Incinerate—ash 7–10 p. c. 3. Ether dissolves 60 p. c., which solution evaporated gives soft extract with hop odor; solvents: acetone, alcohol, ether, boiling water; contains choline (lupuline), volatile oil 3 p. c., lupamaric acid (hop-bitter), $C_{25}H_{35}O_4$, resin, wax (myricin), valeric acid (?). Stimulant, tonic, anodyne; similar to hops, but stronger, more reliable and sometimes preferable. Should be kept dry in well-closed bottles. Dose, gr. 5–15 (.3–1 Gm.); extract, gr. 5–10 (.3–.6 Gm.); fluidextract (alcohol), ♏v-30 (.3–2 Ml. (Cc.)); oleoresin (acetone, ether), gr. 5–15 (.3–1 Gm.); tincture, 12 p. c. (alcohol), ʒss–2 (2–8 Ml. (Cc.)); ammoniated tincture, 10 p.c. (ar. spts. ammonia), ʒss–1 (2–4 Ml. (Cc.)); pills (excipient—little ether, gentle heat or brisk rubbing with spatula).

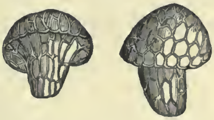


FIG. 90.—Lupulin (fresh).

Allied Plants:

1. *Fi'cus Car'ica, Fig.*—The partially dried fruit, official 1820-1910; W. Asia, cult. in S. Europe, California. Tree, 4.5–7.5 M. (15–25°) high, 10–20 Cm. (4–8′) thick, many spreading branches; bark reddish, gray; leaves 10–12.5 Cm. (4–5′) long, 3–5-palmately bluntly lobed, dentate, pubescent beneath; flowers monœcious, borne on the inside of the thick, fleshy-walled receptacle, which becomes the fruit. Fruit irregular shape, compressed, fleshy, brownish-yellow, frequently with an efflorescence of sugar, apex with small scaly orifice, base with scar or short stalk; internally hollow, with many small brownish-yellow, glossy, hard achenes; odor distinct, fruity; taste sweet, pleasant; pear-shape when softened in water 5–7.5 Cm. (2–3′) long. They occur as *natural* and *pulled*, the largest and best being—Smyrna (Turkey,

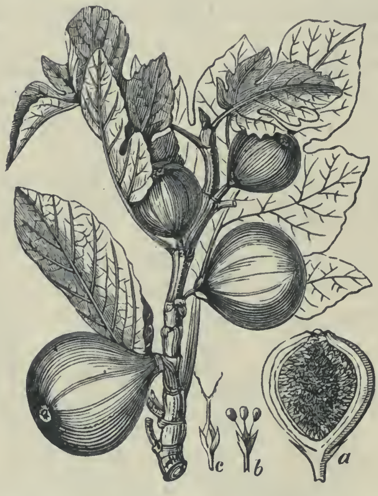


FIG. 91.—*Ficus Carica:* *a*, vertical section of fruit; *b*, staminate flower; *c*, pistillate flower.

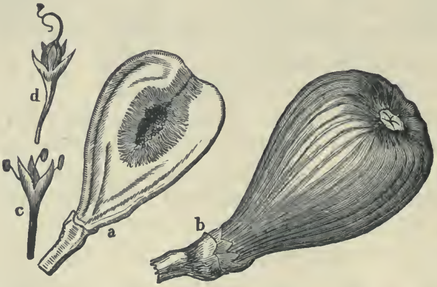


FIG. 92.—*Ficus Carica:* *a*, vertical section of common receptacle; *b*, ripened fruit; *c*, staminate flower; *d*, pistillate flower.

Elemi), the smaller and less pulpy—the Greek; contain grape-sugar 62 p. c., gum, fat, phosphates, chlorides, achenes and cellular tissue 15 p. c., water 16 p. c. Nutritive, demulcent, dietetic; habitual constipation—fresh juice, indigestible skin and seeds causing intestinal irritation, the latter acting mechanically; roasted and split open as a poultice. Dose, *ad libitum.*

2. *Mo'rus ru'bra, Red Mulberry.*—N. America. Fruit in dense spikes with coalesced perianths, 2.5 Cm. (1′) long, dark purple, fleshy; contains sugar 10 p. c., pectin, citrates, malates; refrigerant, flavoring.

3. *Dorste'nia Contrayer'va, Contrayerva.*—The root, official 1820–1860; W. Indies, C. and S. America. Acaulescent perennial; leaves lobed, radical, 10 Cm. (4′) long; flowers staminate and pistillate, fruit capsule, disperses seeds by hygroscopism; root (rhizome) fusiform, 1–2-headed, 5–7.5 Cm. (2–3′) long, 12 Mm. (½′) thick, reddish; taste acrid, bitter; contains volatile oil, resin, bitter principle, starch. Used as stimulant, tonic, diaphoretic, for low fevers, typhoid, diarrhœa, dysentery, serpent bites; in decoction, tincture. Dose, gr. 30 (2 Gm.).

4. *Urti'ca dioi'ca, Nettle* (*Stinging Nettle*), Urticaceæ.—N. America, Europe. Plant .6–1 M. (2–3°) high, very bristly, stinging, leaves ovate, heart-shaped, pointed, serrate, downy beneath, upper stem downy, spike much branched. Tonic, astringent, uterine hemorrhage. Dose, gr. 15–30 (1–2 Gm.).

CANNABIS. CANNABIS.

Cannabis	**sativa,** *Linné,* or var. **indica,** *Lamarck.*	The dried pistillate flowering tops, freed from thicker stems and large foliage leaves, with not more than 10 p. c. of fruits, foreign matter.

Habitat. Asia, Persia, hills of N. India; cultivated in India, Europe, C. and S. Russia, Brazil, W. and S. United States.

Syn. Cannab., Cannabis Indica, U. S. P. 1900, Guaza, Ganjah, Indian Hemp, Black Indian Hemp, Tristram's Knot, Bangue, Hashish, Halish, Gallow Grass Hemp, Neck or Nick Weed, St. Andrew's-lace, Welsh Parsley, Bang, Bhang, Gunjah Churrus, Charas, Ganja (dried flowers); Fr. Chanvre (Indien); Ger. Hanf, Indischer Hanf.

Can'na-bis. L. Gr. *κάνναβις*, hemp, fr. *ganeh*, its Arabic name. Celtic *can*, reed +*ab*, small—*i. e.*, its slender stems.

Sa-ti'va. L. *sativus*, that which is sown or planted—*i. e.*, in the gardens and fields for use.

In'di-ca. L. *Indicus.* Gr. *'Ινδικός*, pertaining to India—*i. e.*, its habitat.

Plants.—Annual herbs; stems 1–3 M. (3–10°) high, angular, tomentose; leaves palmate-compound; leaflets 5–7 linear-lanceolate, serrate; flowers diœcious, yellow spikes. Flowering tops, greenish-brown, compressed, agglutinated fragments 5 Cm. (2′) long, consisting of short stems, bracts, and pistillate flowers, sometimes fruits; stems of varying length, 3 Mm. (⅛′) thick, cylindrical, longitudinally furrowed strigose-pubescent; leaves digitately compound; leaflets linear-lanceolate, sessile, serrate; bracts ovate, pubescent, each enclosing 1–2 pistillate flowers or fruits; calyx dark green, pubescent, folded around ovary or fruit; styles 2, filiform, pubescent; ovule 1; fruit greenish-brown, ellipsoidal, 3.5 Mm. ($\frac{1}{7}'$) long, wrinkled, slightly reticulate; odor agreeably aromatic; taste characteristic. POWDER, dark green, effervescing with dilute hydrochloric acid; microscopically — many sharp-pointed fragments of non-glandular hairs, bracts, leaves with laticiferous vessels, rosette aggregates of calcium oxalate, and calcium carbonate; glandular hairs 2 kinds; oil globules, aleurone grains (crystalloids, globoids); alcoholic solution bright green; alcoholic extractive 8 p. c. Should not be kept longer than 1 year, when it usually is only one-fourth as strong as the fresh, and in 2 years it practically is inert. *Solvent:* alcohol. Dose, gr. 1–5 (.06–.3 Gm.).

Commercial.—Plant was known to the Romans, but not to the Egyptians, and has been cultivated universally many centuries for fibre, seed, and medicine—that for the latter at present being grown mostly in the two districts, Bogra and Rajshabi, north of Calcutta, in rows, the richest in resin at 1,800–2,400 M. (6,000–8,000°) elevation. When mature (indicated by brown color and falling of leaves) the flowering branches are cut off, cured by wilting, pressing, rolling, and shaking out of leaves and fruits (if any of the latter have developed), and as such is recognized natively by the Hindustani names, *ganja, gunjah;* the rolling and treading are preformed by human feet, an art demanding training, the object being possibly to work resinous matter from stems into inflorescence tips. There are two kinds: 1, *Round ganja*, requiring 4 days for kneading each branch into a cylindrical or terete mass; 2, *Flat ganja*, requiring 2 days for working into a flat form; the Bengal (Calcutta) ganja (best) is brownish or dusty, the Bombay bright green. Variability in the drug may be due to the presence of staminate flowers, leaves, fruits, cold weather, inopportune collecting (not later than 4 days after maturing), intentional removal of resin, excessive age (losing most of its properties within a year). Great care is taken to prevent the flowering tops becoming fertilized by suppressing the male plants, as a single one is claimed to spoil an entire field; however, when for fibre or seeds both male and female plants are cultivated together. Our plant, often called *Cannabis america'na,* having escaped from native country, may possess slight variations owing to colder climate, but under proper cultivation and care may be as active as the India product, in spite of which it is regarded generally as being about one-fourth weaker.

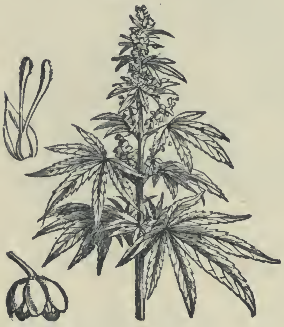


FIG. 93.—*Cannabis sativa.*

CONSTITUENTS.—Cannabinol, Cannabin 15–20 p. c., choline (bilineurine—trimethylamine), volatile oil (chiefly sesquiterpene—cannebene), $C_{10}H_{16}$, .3 p. c., bitter principle, paraffin, $C_{29}H_{60}$, chlorophyll, gum, sugar, potassium nitrate, ash 15 p. c.

Cannabinol, $C_{21}H_{26}O_2$.—This, to which the activity of the drug is due, may be obtained by exhausting cannabis with petroleum benzin, reclaiming latter, evaporating residue to dryness, and subjecting it, under pressure to fractional distillation at 210–240° C. (410–464° F.), when the distillate contains cannabinol and paraffin, the latter being removed with alcohol. It is a poisonous, yellow or brownish syrupy liquid, darkening on exposure to air into inert, brittle, pitchy mass, consequently must be kept, as well as preparations of the drug, in sealed containers.

Cannabin. — Resin constituent (resinoid), to which formerly was attributed all of the drug's activity, that now known to be due solely to its contained cannabinol; it may be obtained by treating cannabis with water and a solution of sodium carbonate, washing residue with water, drying, exhausting with alcohol, treating tincture with milk of lime, precipitating lime with sulphuric acid, adding animal charcoal to filtrate, filtering, concentrating, and precipitating with water; it is a brown, amorphous resin, burning without ash, soluble in alcohol, ether, from the former being precipitated white by water.

PREPARATIONS. — 1. *Extractum Cannabis.* Extract of Cannabis. (Syn., Ext. Cannab., Extract of (Indian) Cannabis (Hemp); Fr. Extrait de Chanvre (Indien); Ger. (Indisch) Henfextrakt.)

Manufacture: Macerate, percolate 100 Gm. with alcohol until exhausted, reclaim alcohol, evaporate residue at 70° C. (158° F.), frequently stirring, to pilular consistence, mix thoroughly; after assay add enough glucose for biological standard; yield 12–14 p. c. Dose, gr. $\frac{1}{6}$–1 (.01–.06 Gm.).

2. *Fluidextractum Cannabis.* Fluidextract of Cannabis. (Syn., Fldext. Cannab., Fluid Extract of Cannabis; Fr. Extrait fluide de Chanvre (Indien): Ger. (Indisch) Hanffluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: alcohol; after dissolving soft extract in the reserve, assay and adjust finished volume to its biological standard—amount producing incoördination in a dog; gr. $\frac{1}{2}$ (.03 Ml. (Cc.)) for every 2 pounds (1 Kg.) of body weight. Dose, ♏ij–5 (.13–.3 Ml. (Cc.)).

3. *Tinctura Cannabis.* Tincture of Cannabis. (Syn., Tr. Cannab., Tinctura Cannabis Indica; Fr. Teinture de Chanvre Indien; Ger. (Indisch) Hanftinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: alcohol. Dose, ♏v–30 (.3–2 Ml. (Cc.)).

These preparations give varying results, but usually their value can be recognized by the color of the precipitate formed when added to water; if olive-green, it is active; if yellowish-brown, it is inert; thus, whatever there is that destroys chlorophyll injures the active principle.

PROPERTIES.—Anodyne, nervine, sudorific, narcotic, aphrodisiac, increases appetite. It excels even belladonna in perverting perception, condition, and relation of objects; some subjects become pugnacious, others have delightful intoxicating dreams, in which time, distance, and sound are magnified—a few minutes' dream extends over weeks, near objects as in infinite space, whispering as cannonading. Large habitual doses bloat the face, inject eyes, make limbs tremulous, weak, mind imbecilic, death by marasmus.

Uses.—Neuralgia, distressing cough, gout, delirium tremens, tetanus convulsions, chorea, hysteria, mental depression, epilepsy, morphine and chloral habits, softening of the brain, nervous vomiting.

Poisoning: Have pleasurable intoxication, double consciousness followed by drowsiness, unconsciousness, collapse, insensibility, dilated pupils, rapid pulse, slow respiration, debility, pale, clammy, insensitive skin, catalepsis, excited passion; effects usually last 24 hours, and closely resemble those of opium, differing, however, in not constipating and in not lessening secretions; increases appetite. Give emetics, lemon juice to neutralize its effects, tannin, coffee, ammonia, strychnine, atropine, electricity, spirit of nitrous ether, artificial respiration; similar to hydrated chloral and opium.

Incompatibles: Strychnine, caustic alkalies, acids.

Synergists: Alcohol, ether, bromides, cocaine, narcotics.

Allied Native Products:

These are mostly used for smoking, beverages, or electuaries, etc.

1. *Bhang* (*Sidhee, Subjee, Siddhi*).—Consists of the dried coarsely broken leaves and fruit (dark green), resembles *ganja* in odor and taste; used by natives in their sweet-meat (*majoon*), also smoked with or without tobacco; its cold infusion (tea) as an intoxicant.

2. *Churrus, Churras, Charas.*—This is the resin (practically the active constituent) which exudes spontaneously from the entire plant in minute drops. It is collected in several different ways: 1. By men, wearing leather suits, brushing forcibly against growing plants, whereby resin adheres and afterward is scraped off. 2. By rubbing green portions between the hands and then scraping off adhering resin. 3. By frequent stirring around that put away in barns to cure, thus causing the resin to rise in the form of dust, and to deposit upon the roof and sides of the building, from which it can afterward be collected. Owing to this being more or less impure it is not used in medicine, but solely smoked in pipes; contains usually cannabinol 33 p. c.

3. *Hashish* (*Hasish, Haschisch, Hasash, Hasheesh—Majoon.*—The Arabic name for hemp, signifying "green intoxicating liquor" fr. Heb. *shesh*, to be joyous. This may consist of the dried tops collected before seeds ripen, thereby resembling *ganja, gunjah*, but usually is more complex, being prepared by heating tender leaves and tops 4 parts, butter 3, water 4, until latter is dissipated, straining, washing twice the greenish extract with water, adding this to syrup (sugar 16, water 32, little milk, boil), heating, mystifying by incorporating stramonium or nux vomica; in Bengal a small amount of rose oil, musk, cardamom seed, cantharides, or opium (to which mostly is due the deliriums, manias, dreams, sensualism), boiling half an hour, allowing to solidify, cutting into cakes; the Russians prefer it formed into cakes with the resinous extract.

4. *Hemp Seed* (*Cannabis Semen*).—These are achenes 3 Mm. (⅛′) long, roundish, smooth, greenish, taste sweet, oily. Used for birds chiefly, but, owing to the fixed oil, an emulsion becomes a valuable demulcent and anodyne; contain proteid 22–24 p. c., fixed oil 28–36 p. c., suitable for painting, varnishing, etc.

5. *Hemp Oil.*—A greenish fixed oil, lighter and brownish on exposure; odor hemp-like, taste mild. Demulcent, protective; chiefly extracted for its possible use in the domestic arts; neither this nor seeds possess narcotic properties.

6. *Hemp Fibre.*—Used for cordage, sacking, sail cloths, clothing, etc. The colder climates produce the best fibres, and the tropics that which is most medicinal and intoxicating. Russia produces most of the hemp fibre, but Italy the best; that grown in the United States and India is inferior to that of the other two countries.

19. SANTALACEÆ. Sandalwood Family.

San-ta-la′se-e. L. *Santal-um* + aceæ. Pers. name *sandul*, useful, or fr. L. *sandal*, Gr. *σάνταλον*, the classic name for Skt. *chandana*—*chand*, shine; L. *candere*, to shine—*i. e.*, polished woody surface shines. Herbs, shrubs, trees. Distinguished by leaves entire, exstipulate; calyx 3–6-lobed, coherent with 1-celled ovary, superior, valvate; flowers perfect, greenish, petals none, stamens 3–9, ovules 1–4, suspended; fruit 1-seeded, drupe or nut; temperate climates, tropics; astringent, seed oily, fruit edible.

Genus: **1. Santalum.**

SANTALUM ALBUM. WHITE SANDAL.

Oleum Santali. Oil of Santal, *official.*

Santalum album, *Linné.* { A volatile oil distilled from the wood, containing 90 p. c. of alcohols, calculated as santalol.

Habitat. S. India, E. Indian Islands, Malabar, Macassar (mountains); cultivated.

Syn. White Sandal Wood (young wood), White Saunders, Saunders, Yellow Sandal (old wood), Almug; Ol. Santal., Santalwood Oil, Oil of Sandalwood, Oleum Ligni Santali, Oleum Santali Flavi; Fr. Santal Citrin; Essence de Santal, Oleum Santali æthereum; Ger. Gelber Sandel; Sandelöl, Santelöl, Ostendisches Sandelholzöl.

San′ta-lum. L. see etymology, above, of Santalaceæ.
Al′bum. L. *albus*, white or light—*i. e.*, the color of the sapwood.

Plant.—Small tree 6–9 M. (20–30°) high, bark grayish-brown; leaves oval, smooth, glaucous beneath; flowers small, numerous cymes; odorless, color variable, violet-pink, red, yellow. Wood, yellow inside (heartwood), white outside (sapwood). The heartwood only should be used, which natively is obtained by felling trees of .3 M. (12′) diameter, hacking off sapwood, or allowing these trunks to remain on the ground until sapwood is eaten away by ants, thereby becoming 10–20

Cm. (4–8′) thick. This, when rubbed, rasped, or heated, gives pleasant roseate odor.

CONSTITUENTS.—Volatile oil 2–5 p. c., resin, tannin.

Oleum Santali. Oil of Santal.—This volatile oil, distilled from the wood, is a pale yellow, somewhat thick liquid, characteristic odor and taste of sandalwood, soluble in 5 vols. of 70 p. c. alcohol, solution being slightly acid, sp. gr. 0.972, lævorotatory; contains alcohols, calculated as santalol (most important constituent), $C_{15}H_{26}O$, 90 p. c., and santalal, $C_{15}H_{24}O$, both being decomposed by distillation over P_2O_5—santalol yielding santalene, $C_{15}H_{24}$, and santalal giving $C_{15}H_{22}$; also present sesquiterpene, possibly acids. *Tests:* 1. Australian oil, sp. gr. 0.953, and W. Indian oil, sp. gr. 0.965, are both dextrorotatory. 2. Should be clear in 10 vols. of 70 p. c. alcohol (abs. of cedar-wood oil, castor oil, other fatty oils). Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏v–20 (.3–1.3 Ml. (Cc.)).

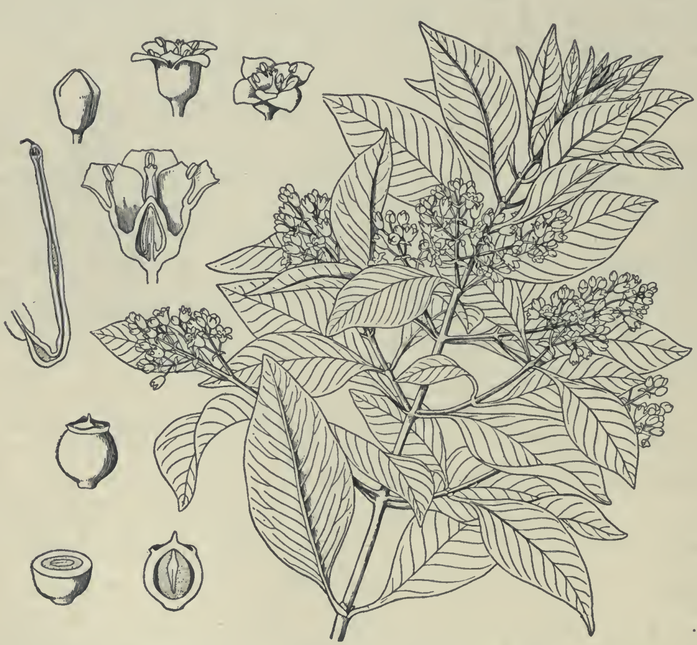


FIG. 94.—*Santalum album:* flowering branch; also flower and fruit, enlarged.

ADULTERATIONS.—Castor oil, other fixed oils, chloroform, gurjun balsam oil, volatile oil of copaiba and of cedar-wood, made from lead-pencil chips by distillation, etc. While that distilled in India and Germany is a good article, that made in England is considered the best and purest, hence is more expensive.

PREPARATIONS.—(Unoff.) WOOD: *Fluidextract,* dose, ʒss–2 (2–8 Ml. (Cc.)). OIL: *Capsules. Emulsion. Massa. Pills. Wafers.*

Properties.—Astringent, stimulant, diuretic, disinfectant, expectorant. Excreted by bronchial and genito-urinary mucous membranes, stimulating and disinfecting secretions of both.

Uses.—Bronchitis, gonorrhœa, chronic and subacute inflammations of mucous membranes, cystitis, pyelitis, chronic diarrhœa. Very much like copaiba and cubeb in action, and should be continued some time after discharges have ceased. Extensively employed in perfumery. The wood is used natively for fevers, indigestion, palpitation, inflammations, skin diseases; also as incense in Chinese temples, and by cabinet-makers for caskets, jewel boxes, and as a perfume. There are three varieties: 1, Malabar; 2, Macassar; 3, W. Indian.

Allied Plants:

1. *Santalum Freycinetia'num* and *S. pyrula'rium* of the Sandwich Islands. *S. Ya'si* of the Feejee Islands. *S. austro-caledon'icum* of New Caledonia. All 3 furnish oil of good quality.

2. *Venezuela Sandal Wood.*—Rutaceæ. This supplies the market with W. Indian sandalwood oil.

20. ARISTOLOCHIACEÆ. Birthwort Family.

Ar-is-to-lo-ki-a'se-e. L. *Aristolochi-a* + aceæ, fr. Gr. ἄριστος, best, + λοχεία, childbirth—*i. e.*, once thought to ease labor. Low herbs, climbing shrubs. Distinguished by abounding in bitter principles and volatile oils; flowers perfect, dull color; calyx conspicuous, lurid, tubular, coherent with 6-celled ovary, forming a many-seeded, 6-celled capsule or berry fruit; petals none; stamens 6–12, epigynous; leaves cordate, entire, petioled; temperate climates; tonic, stimulant, acrid, cures snake bites.

Genus: **1. Aristolochia.**

SERPENTARIA. SERPENTARIA.

Aristolochia	**Serpentaria,** *Linné*, **reticulata,** *Nuttall*.	The dried rhizome and roots, with not more than 10 p. c. of stems, foreign matter.

Habitat. United States, in hilly woods: 1. W. Pennsylvania, Virginia, Ohio, Indiana, Kentucky. 2. S. W. States, Louisiana to Texas.

Syn. Serpent., Virginia Snakeroot, Texas Snakeroot, Snakeroot (-weed), Serpentary, Sangrel, Snagrel, Sangree Root, Pelican Flower, Birthwort, Thick Birthwort; Br. Serpentariæ Rhizome (radix), Serpentary Rhizome; Fr. Couleuvrée de Virginie, Serpentaire (Vipérine) de Virginie; Ger. Virginische Schlangenwurzel.

Ar-is-to-lo'chi-a. L. see etymology, above, of Aristolochiaceæ.

Ser-pen-ta'ri-a. L. *serpen(t)s*, serpent—*i. e.*, having power of rendering harmless serpent bites.

Re-tic-u-la'ta. L. *reticulatus*, fr. *rete*, a net—*i. e.*, leaves strongly netted.

Virginia Snakeroot. Root from Virginia, once thought a valuable antidote for snake bites.

Plants.—Perennial herbs; stems sometimes several, slender, erect, zigzag, jointed, .3 M. (1°) high, purple below; leaves cordate, ovate, 5–7.5 Cm. (2–3') long, pale green, entire; flowers June–July, few, purple, due to the calyx, which is tubular, inflated at both ends and bent like letter S; corolla absent; leaves (*A. Serpentaria*)—petiolate, pointed, thin, pubescent; leaves (*A. reticulata*)—subsessile, obtuse, thickish, reticulate, hairy. RHIZOME, oblique, subcylindrical, more or less curved, 10–30 Mm. ($\frac{2}{5}$–$1\frac{1}{5}'$) long, 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}'$) thick, dark brown, upper portion with short stem-bases, lower and lateral portions with many long, thin, nearly straight, yellowish-brown roots having 4–6-rayed stele (stem 6–10 fibro-vascular bundles); fracture short; internally yellowish-white, wood with broad, eccentric wedges; odor terebinthinate; taste bitter, aromatic. POWDER, grayish-brown; microscopically—numerous starch grains, .003–.014 Mm. ($\frac{1}{8300}$–$\frac{1}{1800}'$) broad, tracheæ, wood-fibres, medullary ray cells, pith cells, occasionally few non-glandular hairs of the stem. *Solvents:* alcohol; diluted alcohol; boiling water. Dose, gr. 5–30 (.3–2 Gm.).

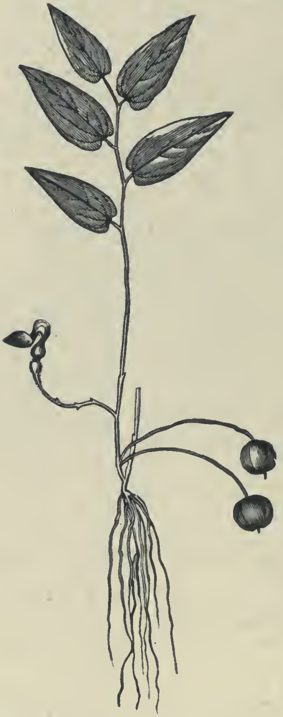


FIG. 95.—*Aristolochia Serpentaria.*

ADULTERATIONS.—Rhizomes of: 1, *Spigelia marylandica*—only slightly aromatic and bitter, no projecting stem-remnants, but indistinct medullary rays in the wood; 2, *Hydrastis canadensis*—yellow interior, odorless, oblique growth; 3, *Aristolochia Serpentaria* var. *hasta'ta,* S. Ca., La.—leaves auriculate, stems smaller, more simple and slender; 4, *Cypripedium hirsutum* (*pubescens*) and *C. parviflorum*—scars circular, roots coarse; 5, *Polemo'nium rep'tans*—resemble serpentaria, but nearly white; 6, Roots of *Panax quinquefolium, Ginseng.*

Commercial.—Plants grow in rich shady woods from which the rhizomes are taken and dried, sometimes having been washed; enters market in bags, casks, more commonly bales of 100 pounds (45 Kg.), often mixed with leaves, stems and adhering earth. There are two varieties: 1, *Virginia Snakeroot* (*A. Serpentaria*), exterminated practically from many former sections, and now largely from mountainous districts, south of Pennsylvania and the Ohio River, being brought eastward chiefly by the routes of Wheeling and Pittsburgh; 2, *Texas Snakeroot* (*Red River—A. reticulata*), rhizome usually larger, roots fewer, thicker, less interlaced than preceding.

Constituents.—Volatile oil .5–1 p. c., Aristolochine, Aristolochin (clematitin, bitter principle), Serpentarin (bitter principle, poisonous), resin 5 p. c., tannin, starch, sugar, mucilage, albumin, ash 11 p. c.

Volatile Oil.—Obtained by distilling with water; contains a terpene (probably pinene), $C_{10}H_{16}$, also borneol ester, $C_{18}H_{29}O$, 60 p. c., and a green or bluish-green fraction.

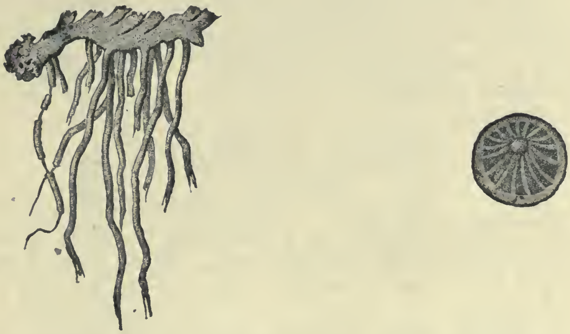


Fig. 96.—Serpentaria: rhizome with roots. Rhizome: transverse section.

Aristolochine, $C_{32}H_{22}NO_{13}$.—Obtained by precipitating decoction with lead acetate, exhausting precipitate with hot alcohol, evaporating, dissolving bitter principle (alkaloid) by shaking with water; it is yellow, amorphous or in needles; soluble in water, alcohol, ether, precipitated by tannin.

Preparations.—1. *Tinctura Cinchonæ Composita*, 2 p. c.

Unoff. Preps.: Fluidextract (alcohol 80 p. c.), dose, ♏v–30 (.3–2 Ml. (Cc.)). *Infusion*, 5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)). *Tincture*, 20 p. c. (alcohol 67 p. c.), dose, ʒss–2 (2–8 Ml. (Cc.)).

Properties.—Stimulant, tonic, diaphoretic, diuretic, emmenagogue, aphrodisiac, antiperiodic; like calumba promotes appetite, digestion, increases bronchial and intestinal secretions, heart action, mental exhilaration. Large doses are irritant, causing vomiting, vertigo, colic, purging, tenesmus.

Uses.—As a stimulating expectorant in typhoid pneumonia, exanthematous diseases, intermittents, dyspepsia, diphtheria. Fluidextract good locally against poison-ivy rash.

Allied Plant:

1. *As′arum canaden′se, Wild Ginger.*—The rhizome (root), official 1820–1880; North America. Small plant with dividing stem; leaves 2, reniform; flowers brownish-purple, woolly; fruit capsule, 6-celled; rhizome 10 Cm. (4′) long, 3 Mm. ($\frac{1}{8}$′) thick, square or 2-edged, brownish, aromatic, pungent, bitterish; contains volatile oil 1.5–3.5 p. c., resin, asarin. Used as stimulant, carminative, tonic, diaphoretic, diuretic, for whooping-cough, colic, febrile affections. Dose, gr. 30 (2 Gm.); comp. syrup, 6.2 p. c., + fldext. ipecac .3, potassium carbonate .25, +, ʒss–1 (2–4 Ml. (Cc.)); infusion, tincture.

21. POLYGONACEÆ. Buckwheat Family.

Pol-i-go-na′se-e. L. *Poligon-um* + aceæ, fr. Gr. *πολύς*, many, + *γόνη*, knee, joint—*i. e.*, from stem's numerous joints. Herbs, shrubs. Distinguished by acrid, astringent, purgative properties, stems composed of many swollen joints, with ocreate stipules above each; flowers perfect, on jointed pedicels; calyx 3–6, greenish or petaloid, inferior; ovary 1-celled, superior, styles and stigmas 2–3; stamens 6–9; fruit 3-angled, seed solitary; temperate climates; astringent, purgative; contain oxalic acid and oxalates.

Genus: **1. Rheum.**

RHEUM. RHUBARB.

Rheum { **officinale,** *Baillon,*
palmatum, *Linné,* and var.
tanguticum, *Maximowicz,*
and probably other species. } The rhizomes and roots grown in China, Thibet, deprived of most of the bark tissues and carefully dried.

Habitat. W. and C. China, Thibet, Chinese Tartary; mountains, southern exposure—light, loose, sandy and rich black forest soil.

Syn. Turkey or China Rhubarb; Br. Rhei Rhizoma; Fr. Rhubarbe de Chine; Ger. Rhizoma Rhei, Rhabarber.

Rhe′um. L. Rha, the river Volga, upon whose banks it grows and was first found, fr. Gr. *ῥῆον*, *ῥεῖν*, to flow—*i. e.*, it causes purgation.

Of-fi-ci-na′le. L. *officina*, workshop; *opus*, work, + *facere*, to do—*i. e.*, used in or belonging to the shop or store.

Pal-ma′tum. L. *palmatus*, fr. *palma*, palm of the hand—*i. e.*, the much divided leaves.

Tan-gut′i-cum. L. pertaining to Tangut, district of Kansu, in Northwestern China—*i. e.*, plant's habitat.

Rhubarb, contraction of *rheubarbarum*—*rheum* + *barbarum*—*i. e.*, barbarian plant from the Rha (Volga), whence name *rha Ponticum*—*Pontic-rha*, *R. rhaponticum*, fr. Pontic or Euxine Sea.

Plants.—Large compact perennial herbs; aërial stem persisting through the winter, after a few years 30 Cm. (1°) high, 10–15 Cm. (4–6′) thick, branches 25–37.5 Cm. (10–15′) long, blunt summit, brown coat from withered scales (ocreas) and leaf-bases; internally fleshy (semi-pulpy) with yellowish juice; leaves very large, petiole .3–.5 M.

(12–18′) long, 2.5–4 Cm. (1–1$\frac{3}{5}$′) thick, solid; lamina .6–1.3 M. (2–4°) long and broad, suborbicular, palmately-veined, 5–7-lobed, reticulate, pubescent, pale green; stipules very large; flowering branches (stems) several, 1.5–3 M. (5–10°) high, hollow, thick, green, striate, smoothish; flowers May–June, 6 Mm. ($\frac{1}{4}$′) long, clusters of 7–10, catkin-like compound panicles, greenish-white; fruit August, small clusters, 12 Mm. ($\frac{1}{2}$′) long, 6 Mm. ($\frac{1}{4}$′) broad, triangular, wing at each angle, crimson-red; seed solitary. RHIZOME, subcylindrical, barrel-shaped, conical, *rounds,* or plano-convex, *flats,* or irregular pieces, frequently with a perforation; hard, moderately heavy, 5–17 Cm. (2–7′) long, 5–10 Cm. (2–4′) thick, or cut into variable shape and size; yellowish-brown, mottled, with alternating, longitudinal striæ of grayish-white parenchyma and brownish medullary rays, small stellate groups of fibrovascular tissue, occasionally reddish-brown cork patches; smooth, sometimes covered with brownish-yellow powder; fracture uneven, granular, characteristic mottled appearance; odor aromatic, characteristic; taste characteristic, slightly bitter, astringent, gritty when chewed, tingeing saliva yellow. POWDER, orange-yellow, red with alkalies; microscopically—rosette aggregates of calcium oxalate, many starch grains, .002–.02 Mm. ($\frac{1}{12500}$–$\frac{1}{1250}$′) broad, few reticulate or spiral tracheal fragments. *Tests:* 1. Boil .1 Gm. with aqueous solution

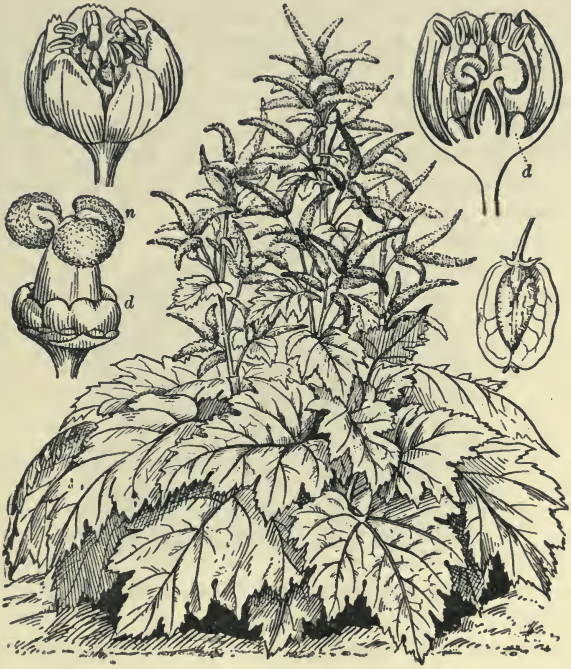


FIG. 97.—*Rheum officinale:* n, pistils and stigmas; d, nectar tubes.

of potassium hydroxide (1 in 100) 10 Ml. (Cc.), cool, acidulate filtrate with hydrochloric acid, shake with ether 10 Ml. (Cc.); ethereal layer (yellow on standing) shaken with ammonia water 5 Ml. (Cc.)—ammonia water layer cherry-red color (pres. of emodin), ethereal layer remains yellow (pres. of chrysophanic acid); not more than 15 p. c. of the drug should show a hollow or dark central area. Should be kept in tightly-closed containers, adding occasionally a few drops of chloroform or carbon tetrachloride to prevent insect attack. *Solvents:* alcohol; water. Dose, gr. 5–30 (.3–2 Gm.).

Adulterations.—Irrespective of variety, rhubarb should be moderately heavy, compact, bright color, brittle, broken edges with fresh appearance, red and yellow veins intermingled with white, decidedly aromatic odor, bitter, astringent, slightly gritty, non-mucilaginous, staining saliva yellow; pieces that are porous, mucilaginous taste, dark brown interior should be rejected. Turmeric sometimes added to the powder and also rubbed over unsightly pieces—recognized by its starch grains, as well as by adding to 5 gr. (.3 Gm.) of suspected rhubarb a few drops of chloroform on white paper, when Chinese slightly stains the paper, while the European, or dark-colored Chinese, imparts a deep yellow stain; now on adding a few grains of borax + a drop of hydrochloric acid, if pure rhubarb—stain not changed, if tumeric present—get a distinct red.

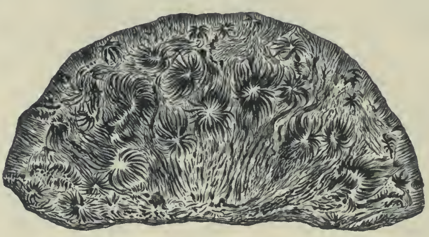


Fig. 98.—Russian rhubarb: transverse section.

Commercial.—Plants, resembling our garden rhubarb—pie-plant, grow wild and largely under cultivation in Chinese Empire, where a number of species, chiefly the three recognized, furnish the official product. Rhizome, when 8–10 years old, is dug (Tartary, spring, autumn; China, Sept.–Oct.), and, after removing roots and corky layer, is divided into segments (to aid drying), perforated, strung on cords, and suspended in the shade or under cover (house roofs and eaves) to be cured by circulating air, a process that often requires a year and a loss of 80 p. c.; frequently that dried by the sun, heated stones, stoves, ovens, kilns, or brushwood fires, *high dried* (usually having broad ridges, blackish grooves, heavy disagreeable odor) and the larger roots, *tails,* are included, both being more or less inferior. Variety and quality are distinguished, in experienced hands, by odor (bouquet), while all kinds are subject to insect attack, which is prevented best by keeping in tightly-closed containers having a tuft of cotton saturated with chloroform or carbon tetrachloride. Most of our supply comes from Hankow, on the Upper Yang-tse, that from Hsining (Tze-chuen and Shensi products) commanding the highest price. There are three varieties: 1, *Russian* (*Turkish*, *Crown—R. palmatum*), no longer on the market, but consisted of the best rhizome, from Chinese Tartary via Siberia, trimmed to beneath the cambium, perforated with large conical hole (for easy examination), inspected rigorously at Kiachta, refuse burned, the reserve sewed in linen sacks, covered with hide, and sent to Petrograd (St. Petersburg); Turkish ports once supplied it (hence name), being brought from Tartary by caravans through Persia and Anatolia; 2, *Chinese* (*E. Indian—R. officinale, R. palmatum*, var. *tanguticum*, etc.), our official rhizome, having inner bark, and sometimes patches of rough corky layer and twine fibres; color less bright and odor less aromatic than Russian; flourishes best at 2,400–3,000 M. (8,000–10,000°) elevation in the Himalaya and other mountains, on the shady side of damp ravines, with northern exposure; distinguished natively as "northern" and "southern," also as "Shensi" (best, most expensive—orange color, agreeable odor), "Canton" (smoky odor, bitter, ochre-yellow), "Shanghai" (smoky odor, light yellow; exported chiefly from Canton, occasionally via India; 3, *European* (*Rhaponticum—R. palmatum, R. rhaponticum, R. compactum, R. undulatum, R. Emodi* +), cultivated in England, France, Austria (Moravia), the rhizome being cut to resemble the Chinese, but differing in having the outside nearly or entirely without white meshes, the medullary rays interrupted, narrow, nearly straight, with paler color, weaker odor, and less gritty but more mucilaginous taste; rarely imported.

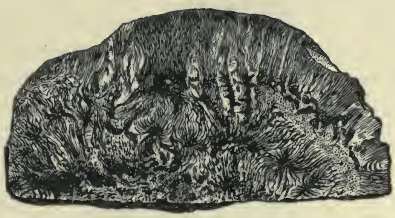


Fig. 99.—Chinese rhubarb: transverse section.

Constituents.—Resin, Aloe-emodin, Chrysophanic acid, rhein, emodin, emodin monomethyl ether, rheinolic acid (new anthraquinone derivative), volatile oil, rheotannic acid, gallic acid, cinnamic acid, palmitic acid, stearic acid, oleic acid, linolic acid, verosterol (phytosterol), dextrose, levulose, calcium oxalate 2–40 p. c. (the greater the amount, the greater the activity of the drug, the two going hand in hand); starch, ash 12–13 p. c.—very inferior 35–45 p. c.

Resin.—Chief purgative principle; amorphous, non-glucosidic—obtained from alcoholic extract, after removing volatile oil, by separating from greenish-yellow residue in still the dark aqueous liquid, extracting it with ether, then with amyl alcohol, evaporating to get brown tarry liquid and yellowish granules, crystals (aloe-emodin, chrysophanic acid, rhein, emodin, emodin monomethyl ether, rheinolic acid—all of which the resin yields upon hydrolysis); evaporate brown tarry filtrate, dissolve in alcohol and precipitate with equal quantity of chloroform.

Aloe-emodin and **Chrysophanic Acid.**—Both slightly purgative, obtained by concentrating above ethereal liquid, heating residue with ethyl acetate, adding petroleum, decanting from tarry precipitate, evaporating petroleum solution, dissolving in ether, extracting with 10 p. c. aqueous solution of sodium carbonate (aloe-emodin), or with 10 p. c. aqueous solution of potassium hydroxide (chrysophanic acid). Aloe-emodin is the rhabarberon and iso-emodin of some writers.

PREPARATIONS.—1. *Extractum Rhei.* Extract of Rhubarb. (Syn., Ext. Rhei., Powdered Extract of Rhubarb, Extractum Rhei Alcoholicum; Fr. Extrait de Rhubarbe; Ger. Rhabarberextrakt.)

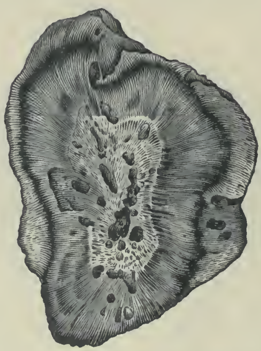


FIG. 100.—European rhubarb: transverse section.

Manufacture: Macerate, percolate 100 Gm. with 80 p. c. alcohol until exhausted, reclaim alcohol, continue distillation until residue syrupy consistence, transfer to a dish, rinse still with little warm menstruum, which add to dish and evaporate to dryness at 70° C. (150° F.), frequently stirring; add magnesium oxide 5 Gm., + dried starch enough for extract to weigh 50 Gm., pulverize, mix thoroughly, pass through fine sieve; 1 Gm. represents 2 Gm. of the drug. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. 3–10 (.2–.6 Gm.).

2. *Fluidextractum Rhei.* Fluidextract of Rhubarb. (Syn., Fldext. Rhei, Fluid Extract of Rhubarb; Fr. Extrait fluide de Rhubarbe; Ger. Rhabarberfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: 80 p. c. alcohol. Dose, ♏v–30 (.3–2 Ml. (Cc.)).

Prep.: 1. *Syrupus Rhei.* Syrup of Rhubarb. (Syn., Syr. Rhei; Fr. Sirop de Rhubarbe; Ger. Rhabarbersirup (saft).)

Manufacture: 10 p. c. Mix fluidextract of rhubarb 10 Ml. (Cc.), spirit of cinnamon .4 Ml. (Cc.), add potassium carbonate 1 Gm., previously dissolved in water 5 Ml. (Cc.), and gradually add this to syrup q. s. 100 Ml. (Cc.). Dose, ʒj–4 (4–15 Ml. (Cc.)).

3. *Pilulæ Rhei Compositæ.* Compound Pills of Rhubarb. (Syn., Pil. Rhei Co.; Fr. Pilules de Rhubarbe composées; Ger. Rhabarber und Aloepillen.)

Manufacture: Mix rhubarb 13 Gm., aloes 10 Gm., myrrh 6 Gm., oil of peppermint .5 Ml. (Cc.), water q. s. 100 pills. Dose, 1–5 pills.

4. *Pulvis Rhei Compositus.* Compound Powder of Rhubarb. (Syn., Pulv. Rhei Co., Gregory's Powder, Powder Magnesia and Rhubarb, Pulvis (Infantum) Antacidus; Fr. Poudre de Rhubarbe composée; Ger. Pulvis Magnesiæ cum Rheo, Kinderpulver.)

Manufacture: 25 p. c. Triturate together rhubarb 25 Gm., Jamaica ginger 10 Gm., then add gradually magnesium oxide 65 Gm.; mix thoroughly, pass through No. 60 sieve. It is pinkish-white, mobile, darker on exposure to moisture; microscopically—fine particles of magnesium oxide, numerous elliptical starch grains (ginger), .005–.06 Mm. ($\frac{1}{3000}$–$\frac{1}{400}$′) broad, and fragments of vegetable tissues; polygonal starch grains (rhubarb), .002–.02 Mm. ($\frac{1}{12500}$–$\frac{1}{1250}$′) broad; mounts in hydrated chloral T. S.—strongly effervesce, showing more clearly tracheæ, parenchyma, starch grains or rosette aggregates of calcium oxalate; with solutions of alkalies—many fragments deep red. Dose, ʒss–1 (2–4 Gm.).

5. *Tinctura Rhei.* Tincture of Rhubarb. (Syn., Tr. Rhei; Fr. Teinture de Rhubarbe; Ger. Rhabarbertinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 101; 1st menstruum: glycerin 10 Ml. (Cc.), alcohol 50 Ml. (Cc.) water 40 Ml. (Cc.), finishing with diluted alcohol q. s. 100 Ml. (Cc.). Dose, ʒss–4 (2–15 Ml. (Cc.)).

6. *Tinctura Rhei Aromatica.* Aromatic Tincture of Rhubarb. (Syn., Tr. Rhei Arom.; Fr. Teinture de Rhubarbe aromatique; Ger. Aromatische Rhabarbertinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 101—using rhubarb 20 Gm., Saigon cinnamon 4 Gm., clove 4 Gm., myristica 2 Gm.; 1st menstruum: glycerin 10 Ml. (Cc.), alcohol 50 Ml. (Cc.), water 40 Ml. (Cc.), finishing with diluted alcohol q. s. 100 Ml. (Cc.). Dose, ʒss–4 (2–15 Ml. (Cc.)).

Prep.: 1. *Syrupus Rhei Aromaticus.* Aromatic Syrup of Rhubarb. (Syn., Syr. Rhei Arom., Spiced Syrup of Rhubarb; Fr. Sirop de Rhubarbe aromatique; Ger. Gewürtzer Rhabarbersirup (saft).)

Manufacture: 3 p. c. Dissolve potassium carbonate .1 Gm. in aromatic tincture of rhubarb 15 Ml. (Cc.), add this to syrup q. s. 100 Ml. (Cc.). Mix thoroughly. Dose, for a child with diarrhœa, ʒj–2 (4–8 Ml. (Cc.)).

Unoff. Preps.: Aromatic Fluidextract, dose, ♏xv–60 (1–4 Ml. (Cc.)). *Fluidglycerate,* 100 p. c., glycerin 50, water q. s. *Infusum Rhei* (Br.), 5 p. c., dose, ʒiv–8 (15–30 Ml. (Cc.)). *Liquor Rhei Concentratus,* 50 p. c., dose, ʒss–1 (2–4 Ml. (Cc.)). *Mistura Rhei Alkalini,* 1.6 p. c.

Mistura Rhei Composita, 1.5 p. c. (fluidext.) + sodium bicarbonate 3.5, fluidext. of ipecac 3, glycerin 35, spirit of peppermint 3.5, water q. s. 100, dose, ʒj–15 (4–60 Ml. (Cc.)). *Pills*, 3 gr., dose, 1–5. *Pulvis Rhei et Magnesiæ Anisatus*, 35 p. c., heavy magnesium oxide 65, anethol 8, alcohol 10. *Aqueous Tincture, Sweet Tincture*, each 10 p. c., dose ʒij–4 (8–15 Ml. (Cc.)). *Tinctura Rhei Composita* (Br.), 10 p. c., + cardamom seeds 1.25, coriander fruit 1.25, glycerin 10, alcohol 45 p. c., q. s. 100, dose, ʒss–1 (2–4 Ml. (Cc.)). *Tinctura Rhei et Gentianæ*, 7 p. c., + gentian 1.75. *Vinum Rhei Compositum*, 8 p. c. +. Dose, ʒj–4 (4–15 Ml. (Cc.)). *Torrefied Rhubarb.*—By roasting, the cathartic principle is volatilized and the full astringency left behind; long boiling will effect the same result.

PROPERTIES.—Aperient, purgative, astringent, stomachic, tonic. It increases saliva, gastric juice, bile, peristalsis, vascularity, and absorption. The cathartic effect comes first (4–8 hours), due to resins (mainly phæoretin), emodin, etc.; then follows astringency from rheotannic acid; both actions being chiefly on the duodenum. The milk, urine, and sweat become colored, the first also acquiring bitterness and purgative properties. Purgation may result from its application to ulcers, abraded skin, or in poultices to abdomen.

USES.—Diarrhœa, hemorrhoids, cholera infantum, chronic dysentery, dyspepsia, thread worms. With calomel good in bilious fevers; with magnesium oxide for stomach and bowel disorders. By association with other cathartics both rendered more efficient; sometimes used with opium.

Allied Plants:

1. *Rheum rhapon'ticum.*—Asia Minor, Siberia, Russia. This is cultivated as pie-plant, the leaf-petioles being used, as they possess pleasant acidulous properties; this species is the source of the cultivated European rhizome, and that of Moravia (Austria), Hungary, England, and Banbury, which is usually less than half the size of official rhubarb, conical, harder, lighter color, more bitter and astringent, less gritty; contains rhapontin, $C_{22}H_{24}O_9$.

2. *R. undula'tum, R. compac'tum, R. Emo'di, R. austra'le, R. hyb'ridum.*—All produce handsome, but smaller, less valuable, and lighter-colored rhizomes.

3. *Ru'mex cris'pus, Yellow Dock.*—The dried root, official 1860–1900; Europe, N. America. Compact perennial springing from a yellow fusiform root, which penetrates far into the ground; stem rises annually 1–1.3 M. (3–4°) high; leaves lanceolate, smooth, margins strongly wavy-curled; flowers greenish, racemes. Root, 10–30 Cm. (4–12′) long, 6–18 Mm. ($\frac{1}{4}$–$\frac{3}{4}$′) thick, fusiform, deeply wrinkled, rusty-brown—internally whitish with reddish medullary rays; bark rather thick, fracture short; odor slight, peculiar; taste bitter, astringent; contains chrysophanic acid (rumicin, lapathin), nepodin, lapodin, tannin, calcium oxalate, starch. Astringent, alterative, tonic, laxative, antiscorbutic; similar to rhubarb and sarsaparilla; cutaneous eruptions, scorbutic manifestations, itch, scrofula, syphilis, hepatic congestion, dyspepsia, intermittents; leaves used as a laxative diet, and as spinach. Dose, gr. 15–60 (1–4 Gm.); fluidextract (diluted alcohol), ♏xv–60 (1–4 Ml. (Cc.)); decoction and ointment also employed.

4. *R. britan'nica, Water Dock.*—The root, official 1820–1860. Europe, naturalized in N. America. Plant 1.6–2 M. (5–6°) high, leaves lanceolate, acute, transversely veined, obscurely crenate, .3–.6 M. (1–2°) long; root more astringent but physically and medicinally similar to *R. crispus,* with which it is often indiscriminately collected.

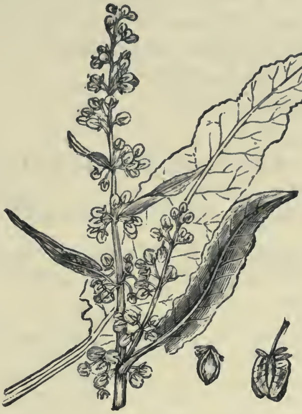


FIG. 101.—*Rumex crispus.*

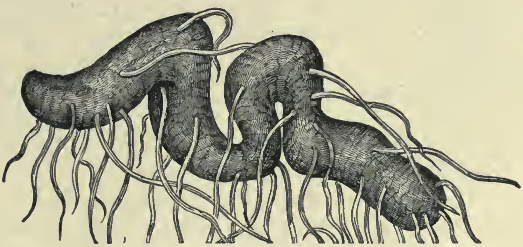


FIG. 102.—*Polygonum Bistorta:* rhizome, natural size.

5. *R. obtusifo'lius, Broad-leaved Dock.*—The root, official 1820–1860. Europe, naturalized in N. America. Common obnoxious weed .6–1 M. (2–3°) high, leaves 15–30 Cm. (6–12′) long, 7.5–10 Cm. (3–4′) wide, sometimes red-veined, ovate, heart-shaped, downy, wavy margins, acuminate; roots similar to *R. crispus,* with which it is often indiscriminately collected, both alike medicinally. *R. sanguin'eus, Red-veined Dock.*—Leaf-veins and stems reddish; *R. aqua'ticus,* fruit smooth, both astringent. *R. Acetosel'la, Field* or *Sheep Sorrel,* contains acid potassium oxalate and tartaric acid, sour taste lost upon drying; refrigerant, diuretic, good diet in scurvy.

6. *Polyg'onum Bistor'ta, Bistort.*—Europe, Asia, N. America, in meadows. Produces an S-shaped rhizome, bent upon itself—bistorted, 5 Cm. (2′) long, 15 Mm. ($\frac{3}{5}$′) thick, flattened or channeled, upper side transversely striate, root-scars on under side, red-brown; contains tannin 20 p. c., starch, calcium oxalate; tonic, astringent. Dose, gr. 5–30 (.3–2 Gm.).

22. CHENOPODIACEÆ. Goosefoot Family.

Ke-no-po-di-a'se-e. L. *Chenopodi-um* + aceæ, fr. Gr. χήν, goose, + πούς, foot—*i. e.*, referring to the shape of leaves. Herbs, shrubs. Distinguished by being homely, succulent; leaves exstipulate, no bracts; flowers minute, greenish, with free calyx imbricated in the bud, persistent; 2–5-lobed; petals none; ovary 1-celled, forming 1-seeded utricle; universal, saline places; anthelmintic, antispasmodic, aromatic, carminative, stimulant (vol. oil).

Genus: **1. Chenopodium.**

CHENOPODIUM. CHENOPODIUM.

Oleum Chenopodii. Oil of Chenopodium, *official.*

Chenopodium ambrosioides, var. **anthelminticum,** *Linné.* { A volatile oil distilled from the fruit (or fresh herb).

Habitat. W. Indies, C. and S. America, waste places, roadsides; naturalized in United States, Europe, Africa; cultivated in Maryland for the oil.

Syn. American (Wild) Wormseed, Stinking Weed, Goosefoot, Jerusalem (Jesuit) Tea, Jerusalem Oak (Jak), Fructus Chenopodii Anthelmintici; Ol. Chenopod., Oil of American Wormseed; Fr. Ansérine Vermifuge (plante fleurie), Essence de Chénopode anthelmintique; Ger. Amerikanischer Wurmsamen, Wurmsamenöl, Chenopodiumöl.

Che-no-po'di-um. L. see etymology, above, of Chenopodiaceæ.

Am-bro-si-oi'des. L. fr. Gr. α, priv., not, + βροτός, mortal, + ο-ειδης, like—*i. e.*, resembling that which is immortal, once thought to effect that condition when taken.

An-thel-min'ti-cum. L. fr. Gr. ἀντί, against, + ἕλμινθα, a worm—*i. e.*, worm antagonizer or destroyer.

Plant.—Annual or perennial, .6–1.6 M. (2–5°) high; stem angular, furrowed, branched; leaves toothed, yellowish-green, gland-dotted on under surface; flowers July–Sept., greenish-yellow, dense leafy spikes. Fruit, 2 Mm. ($\frac{1}{12}'$) thick, size of pin's head, depressed-globular, greenish-gray, integuments friable, containing a lenticular, obtusely edged, glossy, black seed; odor peculiar, terebinthinate; taste bitter, pungent. All parts of the plant have this disagreeable odor and same medicinal properties when dry and fresh; grows best in rubbish, along fences, in village streets, vacant lots, and should be collected in October.

Constituents.—Volatile oil 3–3.5 p. c., from fresh herb .5–1. p. c.

Oleum Chenopodii. Oil of Chenopodium.—This volatile oil, obtained by distilling with water or superheated steam, is a colorless, pale yellowish liquid, characteristic, disagreeable odor and taste, soluble in 8 vols. of 70 p. c. alcohol, sp. gr. 0.970, lævorotatory; contains a terpene—pinene, $C_{10}H_{16}$, and a liquid oxygenated portion, $C_{10}H_{16}O$. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏ij–10 (13–.6 Ml. (Cc.)).

Preparations.—(Unoff.) Fruit: *Fluidextract,* dose, ♏xv–30 (1–2 Ml. (Cc.)). *Decoction* (water or milk), dose, ℥j–2 (30–60 Ml. (Cc.)). Fresh-plant: *Expressed Juice,* dose, ʒij–4 (8–15 Ml. (Cc.)), ter die.

PROPERTIES.—Anthelmintic, vermifuge, round worms (*Ascaris lumbricoides*).

USES.—While mainly for worms, it has also been used in intermittents, hysteria, chorea, nervous affections, tænia. May give the powder incorporated with molasses or syrup, but the oil is more popular, being well taken on sugar by children. Should be given twice daily for several days, on empty stomach if possible, and follow with a dose of castor oil. Fruit, official 1820–1900.

Allied Plants:

1. *Chenopodium ambrosioi'des, Herba Botryos Mexicanæ, Mexican Tea.*—The fruit, official 1890–1900; Europe, Asia. This resembles very closely the official plant, the latter being, however, more strongly aromatic, leaves more deeply toothed, the lower ones often nearly pinnatifid, spikes more elongated, usually leafless; fruit of both alike. *C. Bo'trys, Jerusalem Oak* (*Feather Geranium*); Europe, Asia. Strongly aromatic; catarrh, asthma. *C. Bo'nus Henri'cus, Good King Henry;* Europe; taste saline, mucilaginous. *C. al'bum, Pig Weed* (*Lamb's Quarters*); taste mucilaginous, saline. *C. Vulva'ria, Fetid Goosefoot;* Europe; plant has fish-brine odor, due to trimethylamine.

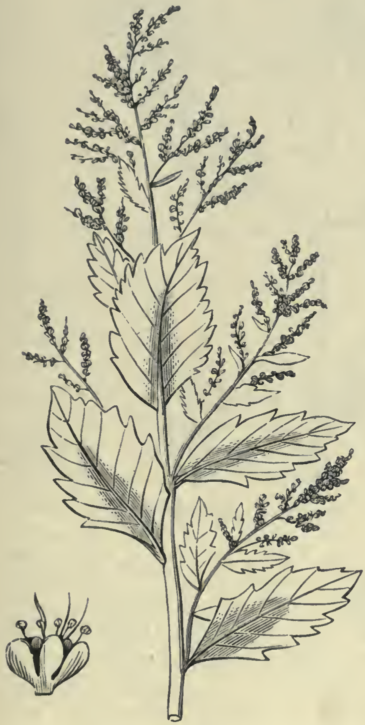


FIG. 103.—*Chenopodium ambrosioides* var. *anthelminticum.*

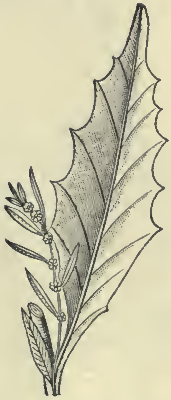


FIG. 104.—*Chenopodium ambrosioides.*

2. *Phytolac'ca decan'dra, Poke Weed* (*Root*).—Phytolaccaceæ. The dried root, collected in autumn, official 1820–1910; N. America, waste places. Perennial herb, 1.3–2.5 M. (4–8°) high; stem annual, 2.5–5 Cm. (1–2′) thick, purplish, hollow; leaves 12.5 Cm. (5′) long, ovate, smooth, rich-green, entire; flowers greenish-white, racemes; fruit

purplish berry, 8 Mm. (⅓′) thick, 10-seeded, juice purplish-red. Root, cylindrical, 3–7 Cm. (1–3′) thick, transverse or longitudinal slices, yellowish-brown, wrinkled; internally fibro-vascular tissue and parenchyma, the latter much retracted; odor slight, taste sweetish, acrid; solvents: diluted alcohol, boiling water; contains glucoside—active, poisonous, saponin-like—starch, sugar, calcium oxalate (phytolacc-ine, -in, -ic acid). Alterative, laxative, emetic, resolvent, anodyne, paralyzant; rheumatism, skin diseases, syphilis, ulcers, scabies, eczema, tonsillitis, diphtheria. *Poisoning:* Symptoms and treatment similar to aconite. Dose, alterative, gr. 1–5 (.06–.3 Gm.), emetic, gr. 10–30 (.6–2 Gm.); fluidextract (dil. alc.), ♏v–30 (.3–2 Ml. (Cc.)); decoction, 5 p. c., ʒiv–8 (15–30 Ml. (Cc.)); tincture, 10 p. c., ♏x–60 (.6–4 Ml. (Cc.)). *P. octan'dra*, C. and S. America, and *P. acino'sa*, N. India, are used similarly. All of these furnish young shoots which in spring may be eaten for asparagus, spinach, etc., imparting no odor to urine, but when old none should be taken except in medicinal doses.

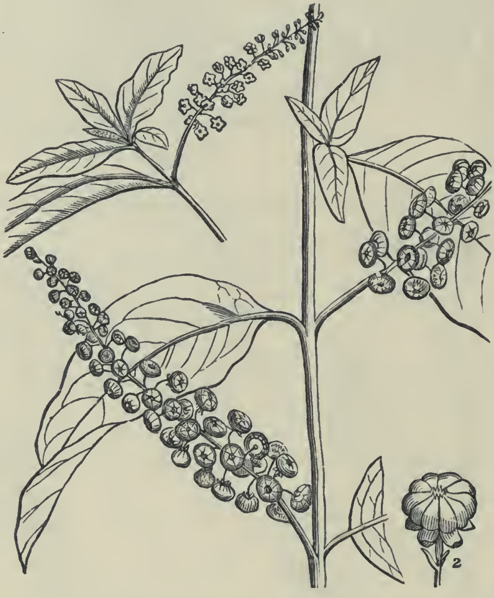


Fig. 105.—*Phytolacca decandra: 2*, single fruit, showing carpels.

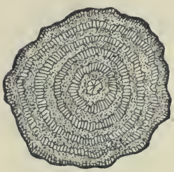


Fig. 106.—Phytolacca root: transverse section, natural size.

3. *Illic'ium ve'rum, Star Anise.*—Magnoliaceæ. The fruit, official 1880–1900; N. Annam, S. W. China (mountains). Small tree, 3–6 M. (10–20°) high, branched; leaves evergreen, lanceolate, pointed, entire, pellucid-punctate, 5–15 Cm. (2–6′) long; flowers greenish-yellow.

Fruit (capsule—integuments 78 p. c., seeds 22 p. c.), star-shaped, being composed of 8 stellately arranged boat-shaped carpels, 8 Mm. ($\frac{1}{3}'$) long, woody, wrinkled, brown, dehiscent on upper suture; internally each carpel glossy, reddish-brown, containing 1 flattish, oval, glossy-brown seed; odor anise-like (*anisatum*); taste sweet, aromatic—seeds oily; contains (integuments)—volatile oil 5.3 p. c. (congeals at 1° C.; 34° F., and consists chiefly of anethol), resin 10.7 p. c., fixed oil 2.8 p. c., saponin, protocatechuic acid, shikimic acid, mucilage, ash 2 p. c.; (seeds)—volatile oil 1.8 p. c., resin 2.6 p. c., fixed oil 20 p. c.; solvents: alcohol, hot water partially. *Adulteration:* Poisonous fruit of the allied species, *Illicium religiosum* (*anisatum*). Carminative, anodyne, stimulant, diuretic; flatulent colic, indigestion, infantile catarrh, bronchitis, rheumatism, earache, flavoring. Dose, gr. 5–30 (.3–2 Gm.); infusion, 5 p. c., ℥j–2 (30–60 Ml. (Cc.)); volatile oil, ♏j–2 (.06–.13 Ml. (Cc.)).

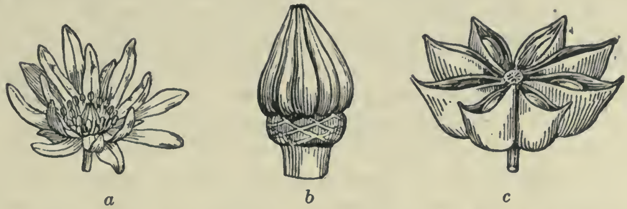


FIG. 107.—*Illicium verum: a*, flower; *b*, fruit carpels of the flower magnified; *c*, fruit.

4. *I. religio'sum* (*anisa'tum*).—Cultivated around Buddhist temples in China and Japan, being called *Shikimi*. Fruit very similar to the preceding, having 8 carpels, but is more woody and shriveled, with thin, upward-curved beak; odor faint, clove-like; taste unpleasant; contains .44 p. c. of a non-solidifying volatile oil, sp. gr. 0.990, shikimic acid, sikimipicrin

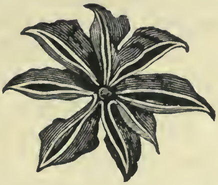


FIG. 108.—*Illicium religiosum* (*anisatum*).

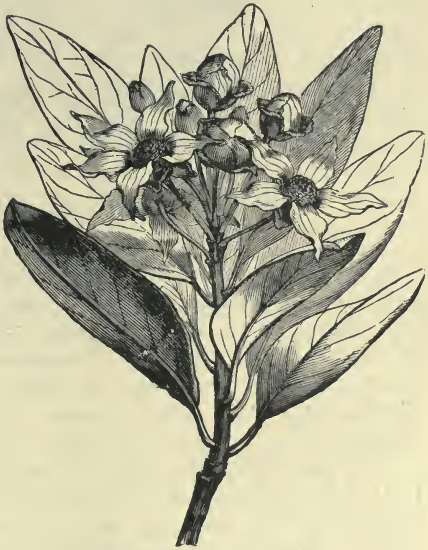


FIG. 109.—*Drimys Winteri.*

(crystalline, bitter), and sikimin (poisonous). The oil consists of a terpene, safrol, $C_{10}H_{10}O_2$, eugenol, $C_{10}H_{12}O_2$, and liquid anethol. The fruit is used natively for killing rats, fish, etc., the latter serving as food in spite of the poison. Upon persons it causes vomiting, epileptiform convulsions, and dilated pupils; *I. florida'num* and *I. parviflo'rum;* Fla., Ga., La.; the former has fruit with 13 carpels, the latter with only 8; barks are substituted sometimes for cascarilla.

5. *Dri'mys Win'teri* (*Win'tera aroma'tica*).—The bark, official 1820–1860; S. America; small tree; leaves coriaceous; flowers white; fruit black berries, 4–8; bark in quills or curves, 2.5–8 Mm. ($\frac{1}{10}$–$\frac{1}{3}$′) thick, grayish-brown, striate, fracture granular, with white stone cells and yellow resin cells, odor of canella and cinnamon, for which drugs it has been substituted; sometimes called Winter's cinnamon; contains volatile oil (which has winterene, $C_{15}H_{24}$), tannin 9 p. c., pungent resin 10 p. c. Used for colic, flatulence, scurvy; in infusion or tincture. Dose, gr. 5–30 (.3–2 Gm.).

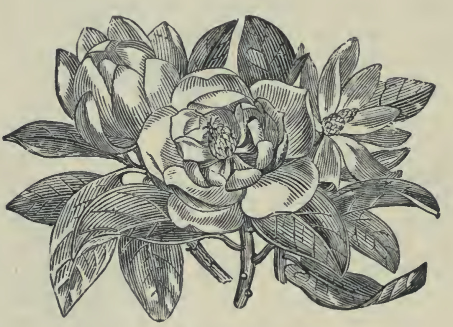


FIG. 110.—*Magnolia acuminata.*

6. *Magno'lia virginia'na* (*glau'ca*), *M. acumina'ta*, and *M. tripet'ala.*—The bark, official 1820–1890; United States; trees 6–28 M. (20–90°) high; flowers white, fragrant; fruit cones; bark in thin quills or curved pieces, orange-brown, glossy, warty, fissured, astringent, bitter; contains volatile oil, resin, magnolin, tannin. Used for malaria, rheumatism, gout, intermittents, catarrhs; in decoction, infusion, tincture. Dose, ʒss–1 (2–4 Gm.).

7. *Lirioden'dron Tulipif'era, Tulip-tree.*—The bark, official 1820–1880; United States, China; tree 18–45 M. (60–150°) high; flowers yellowish; fruit cone, 7.5 Cm. (3′) long. Bark in quills or curved pieces 2 Mm. ($\frac{1}{12}$′) thick, purplish-brown, thin ridges, inside whitish, smooth, astringent; contains volatile oil, resins, liriodendrin, tulipiferine, tannin; injured by boiling. Used for chronic rheumatism, dyspepsia, intermittent fever; in infusion or fluidextract. Dose, ʒss–1 (2–4 Gm.).

23. MYRISTICACEÆ. Nutmeg Family.

Mi-ris-ti-ka'se-e. L. *Myristic-a* + aceæ, fr. Gr. *μυρίζειν*, to anoint—*i. e.*, an ointment used for its sweet odor. Trees. Distinguished by aromatic properties; leaves dotted, entire, stalked, leathery; flowers regular, diœcious, calyx 3–4-cleft, leathery, inferior; filaments 3–12, united, ovary 1-celled, ovule 1; fruit succulent, seed oily; tropics; aromatic, seeds the strongest; bark and pericarp acrid.

Genus: **1. Myristica.**

MYRISTICA. MYRISTICA.

Myristica fragrans, *Houttuyn.* { The ripe seeds deprived of arillus and seed-coats—the kernel.

Habitat. Molucca Islands; cultivated in tropics, India, Philippine Islands, Amboyna, Boura, New Guinea, E. Indies, W. Indies, S. America, Ceylon, Sumatra, Java, etc.

Syn. Myrist., Nutmeg, Round Nutmeg; Fr. Muscade des Moluques, Noix Muscade, Nux Muschata, Nuces Nucistæ; Ger. Semen Myristicæ, Muskatnuss, Myristicasamen.

My-ris'ti-ca. L. see etymology, above, of Myristicaceæ.

Fra'grans. L. *fragran(t)s*, sweet-scented—*i. e.*, from its fragrant odor.

Nut'meg. OE, *nut* + *muge*, musk, corrupted into *meg*—*i. e.*, from its odor.

Plant.—Evergreen tree 7.5–15 M. (25–50°) high, much branched, bark brownish-gray, smooth, young branches green; leaves leathery, smooth, entire, 10–15 Cm. (4–6′) long, acute at both ends, prominently veined, dark green; flowers diœcious, small, yellow; fruit pendulous, smooth, yellow, 7.5 Cm. (3′) long, 5 Cm. (2′) wide, resembling a peach, but grooved by a longitudinal furrow, pericarp, 12 Mm. ($\frac{1}{2}'$ thick, tough, fleshy, with astringent juice, yellowish-white, dehiscing from above along the furrow into 2 equal valves that become dry and coriaceous when ripe, and from between which readily falls out the erect, blunt, single seed closely enveloped, reticulately furrowed and almost completely covered by an irregularly cut fleshy arillus (mace); when deprived of this latter the seed-testa is dark brown, hard, thick, smooth, shining, woody; inner seed-coat thin, membranous, pale brown. Kernel (myristica, nutmeg), ovoid, ellipsoidal, 20–30 Mm. ($\frac{4}{5}$–$1\frac{1}{5}'$) long, 15–20 Mm. ($\frac{3}{5}$–$\frac{4}{5}'$) thick, light brown, reticulately furrowed from the tightly oppressed arillus, broad end with large circular, upraised scar from which arises a furrow extending to the chalaza; easily cut, surface having waxy lustre, mottled from light brown perisperm penetrating into the yellowish-brown endosperm; longitudinal section through endosperm above large scar shows cavity with shrunken remains of embryo and usually with a growth of mold; odor and taste agreeably aromatic. Powder, reddish-brown; microscopically—fragments of perisperm with oil reservoirs containing volatile oil, parenchyma cells filled with aleurone and starch grains, .003–.02 Mm. ($\frac{1}{8325}$–$\frac{1}{1250}'$) broad—blue with iodine T. S., whereas starch in mace—yellowish-red; occasional tracheæ; mounts in hydrated chloral T. S.—shows numerous globules of fixed oil, which may separate in rod-like crystals; mounts in fixed oil—show separated aggregates of crystals which strongly polarize light; powder from "limed" nutmegs under microscope, upon adding water containing 25 p. c. of sulphuric acid—show separation of calcium sulphate crystals (needles, short rods) which do not polarize light. Some accept the hard testa and kernel as the seed, like peach seed, but the U. S. P. recognizes solely the kernel or nucleus, that central part left after the fleshy portion, arillus, and hard testa have been removed. Those that are broken, of light weight, feeble odor and taste, musty, wormy and black-veined should be rejected. Should be kept in tightly-closed containers, adding occasionally a few drops of chloroform or carbon tetrachloride to prevent insect attack. *Solvents:* alcohol; ether. Dose, gr. 5–20 (.3–1.3 Gm.).

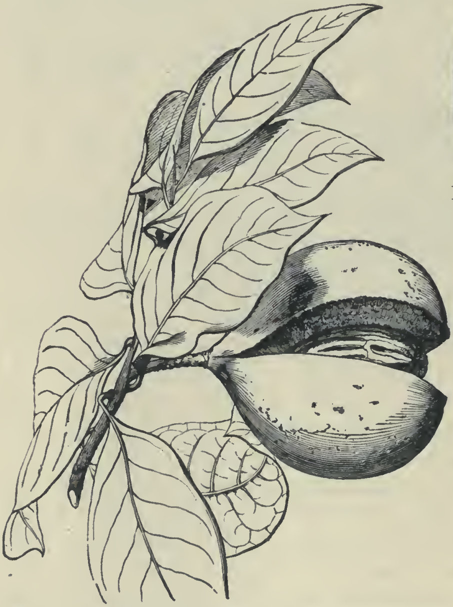


FIG. 111.—*Myristica fragrans:* twig with the fruit.

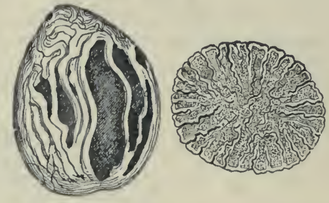


FIG. 112.—Nutmeg, with mace, and transverse section.

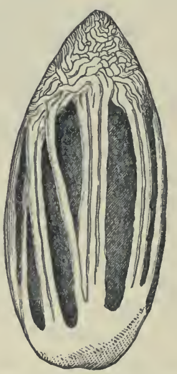


FIG. 113.—Wild nutmeg, with mace.

ADULTERATIONS.—KERNELS: Rare—those punctured, boiled, and plugged, recognized by lightness, insect ravages, and pegs (on breaking open); also false nutmegs, in spite of easy detection: Papua (large), Macassar (small)—*M. fatua* and *M. argentea*—both longer, more narrow and pointed, the former with little aroma after drying, the latter more brittle and aromatic, and furrowed with 4 broad stripes. POWDER (GROUND): Common—partially or wholly exhausted refuse, from percolation or distillation.

Commercial.—Plant prefers light soil, shade, and moist climate, produces fruit when 8–9 years old, matures at 25, and yields annually for 60–70 years. Fruit was unknown to the ancients, Avicenna being the first to notice it, and is collected when split on one or both sides, Sept.–Dec., (also April–June) by means of a hook on a long pole, or by hand, placed into baskets, pericarp and arillus removed, and the seeds, spread on frames to dry by sun or fire at 60° C. (140° F.), being turned over every few days for 2 months. When kernels rattle in the shells, the latter are cracked off with mallets, and the former assorted, the best being rubbed over with powdered lime and packed in white-washed casks or chests for market. The Chinese are supplied with uncracked seeds, while inferior grades are utilized for expressing the fixed oil. There are several varieties: 1, *Unlimed* (*Brown, Penang, Singapore*), as above described, sometimes oily to the touch, and mixed with cloves; 2, *Limed* (*Dutch, Batavian*), prepared in the Banda Islands by steeping the dried seeds for a short time in a mixture of salt water and lime (a protection against insect attacks, and possibly to kill the embryo thereby restricting the culture to their own provinces), then exposing to the sun several days and packing for market; 3, *Artificial*, prepared by compressing a mixture of earthy and powdery matter, being less aromatic than the genuine, also soft and crumbly when in boiling water 3 minutes; contains volatile oil 2 p. c., fat 15 p. c., ash 11–18 p. c.

CONSTITUENTS.—Volatile oil 2–8–15 p. c., fixed oil 25–30 p. c., starch, proteids, mucilage, ash 2–5 p. c.

Oleum Myristicæ. Oil of Myristica, *official.*—(Syn., Ol. Myrist., Myristica Oil, Oil of Nutmeg, Oleum Nucistæ Æthereum; Fr. Essence de Muscade; Ger. Oleum Macidis, Ætherisches Muskatnussöl.) This volatile oil, distilled from the kernel of the ripe seed with water or steam, is a colorless, pale yellow liquid, characteristic odor and taste of nutmeg; soluble in equal volume of alcohol, in 3 vols. of 90 p. c. alcohol, sp. gr. 0.859–0.924, dextrorotatory; contains chiefly pinene, probably some dipentene, also myristicol, $C_{10}H_{16}O$, and myristicin, $C_{12}H_{14}O_3$. The nutmeg camphor (once thought to be myristin), which sometimes settles on standing, is myristic acid. *Test:* 1. Evaporate 3 Gm. on water-bath—residue .06 Gm. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏ij–3 (.13–.2 Ml. (Cc.)).

Fixed Oil. (Oleum Myristicæ Expressum, Oleum Nucistæ).—Obtained by bruising nutmegs, exposing them in a bag to steam, and expression between heated plates; the oil runs out a liquid, but congeals upon cooling; often called *nutmeg butter*, and improperly *oil of mace;* it is an orange-brown solid, sp. gr. 0.995, melting at 45° C. (113° F.), soluble in hot ether (2), hot alcohol (4); consists mainly of myristin, with some myristic acid, palmitin, olein, resin, volatile oil 6 p. c. Dose, gr. 2–5 (.13–.3 Gm.).

PREPARATIONS.—I. SEED: 1. *Pulvis Aromaticus*, 15 p. c. 2. *Tinctura Lavandulæ Composita*, 1 p. c. 3. *Tinctura Rhei Aromatica*, 2 p. c. 4. *Trochisci Sodii Bicarbonatis*, $\frac{1}{6}$ gr. (.01 Gm.). II. OIL: 1. *Spiritus Ammaniæ Aromaticus*, $\frac{1}{10}$ p. c.

Properties.—Stimulant, stomachic, narcotic, flavoring, condiment, increases gastric juice, digestion, appetite; large doses, like camphor, act on the cerebrum, causing stupor, delirium.

Uses.—Flatulence, carminative, diarrhœa, dysentery, vomiting, colic, dyspepsia.

Allied Products:

1. *Macis, Mace.*—The arillode of the seed of *Myristica fragrans*, official 1850–1900. When fruit first gathered the fleshy pericarp is removed, the thin coating (arillode) enveloping the seed peeled off with a knife, then sprinkled with salt water, as a preservative, and dried by sun or fire; or it may be allowed to remain on the seed until thoroughly dry, when it freely cracks and peels off. It is a brilliant, scarlet (fresh), or brownish-orange (dry), brittle, in narrow bands, 2.5 Cm. (1′) long, branched, lobed above, fatty when scratched or pressed, fracture short, showing many oil-cells; odor fragrant; taste warm, aromatic; contains volatile oil (oleum macidis) 4–9–17–35 p. c., resin 25 p. c., sugar 1 p. c., amylodextrin 1.8 p. c., fixed oil, mucilage, proteids (no starch), ash 1–3 p. c.; solvent: alcohol. Tinctura Macidis, 20 p. c. (alcohol). *Adulterations:* Common (entire and powdered)—nutmeg, starch, ginger, and mace of *M. malabar′ica* and *M. fatua;* this latter readily being detected by darker reddish color, more fatty, resinous, lustrous surface, weaker taste and odor, yielding 10 times more ether-extract, and microscopic specimen turning dark brown with potassium hydroxide solution, becoming yellow with sulphuric acid. Stimulant, tonic, flavoring. Dose, gr. 5–20 (.3–1.3 Gm.).

2. *False, Long, Wild, Male Nutmegs—M. fat′ua* and *M. argen′tea.*—These are 4–5 Cm. (1$\frac{3}{5}$–2′) long, paler and less aromatic than official, the mace inodorous and less deeply lobed.

24. RANUNCULACEÆ. Crowfoot Family.

Ra-nung-ku-la′se-e. L. *Ranuncul-us* + aceæ, dim. of *rana*, a frog; hence little frog, as many species grow in moist places near that reptile. Herbs, shrubs with colorless, acrid, poisonous juice. Distinguished by flowers being regular or irregular, most complete; organs all distinct; no adhesion or cohesion; often yellow; sepals 3–15, mostly 5 (often petaloid); petals 3–15; only 1 circle; stamens many, hypogynous; pistils distinct; seed albuminous, superior; temperate climates; narcotic, bitter, tonic, poisonous.

Genera: **1. Hydrastis. 2. Cimicifuga. 3. Delphinium. 4. Aconitum.**

HYDRASTIS. HYDRASTIS.

Hydrastis canadensis, *Linné.*	The dried rhizome and roots, with not more than 2 p. c. of stems, leaves, foreign matter, containing 2.5 p. c. of ether-soluble alkaloids.

RANUNCULACEÆ

Habitat. N. America, Canada, east of the Mississippi; rich woodlands, mountains.

Syn. Golden Seal, Yellow (Orange) Root, Yellow Puccoon (Indian Paint), Turmeric (Jaundice) Root, Ohio Curcuma, Indian Turmeric (Dye), Ground Raspberry, Eye Balm (Root), Yellow Eye; Br. Hydrastis Rhizoma; Fr. Racine Orange, Sceau d'Or; Ger. Hydrastisrhizom, Canadische Gelbwurzel.

Hy-dras'tis. L. fr. Gr. ὕδωρ, water, + δράω to act—*i. e.*, alluding to the active properties of the juice, or to the plants growing in marshy places.

Can-a-den'sis. L. of Canada—*i. e.*, its northern habitat limit.

Golden Seal—*i. e.*, its yellow scarred rhizome, once used as a paint and dye.

Plant.—Perennial herb 15–30 Cm. (6–12′) high, simple, hairy, 2-leaved near apex, one sessile at top, the other an inch or so below with thick petiole; leaves pubescent, round, cordate, palmately 5–7-lobed, pointed, serrate, 10–22.5 Cm. (4–9′) wide; flowers May–June, only one, greenish-yellow, arising from upper leaf on a peduncle; fruit compound red berry, 12 Mm. ($\frac{1}{2}'$) thick, composed of 12 or more 1–2-seeded berries like raspberry. Rhizome, horizontal or oblique growth, subcylindrical, flexuous, 1–5 Cm. ($\frac{2}{5}$–2′) long, 2–7 Mm. ($\frac{1}{12}$–$\frac{1}{3}'$) thick, grayish-brown, longitudinally wrinkled, annulate from scars of bud-scales; upper surface occasionally with stem-bases, many stem-scars; under and lateral surfaces with easily detached filiform roots;

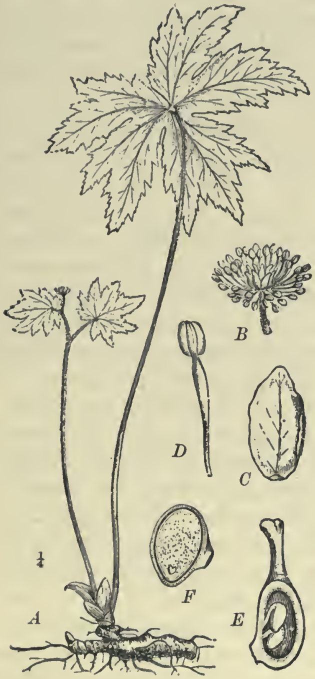


Fig. 114.—*Hydrastis canadensis:* *B*, flower; *C*, petal; *D*, stamen; *E*, fruit carpel, longitudinal section; *F*, seed.

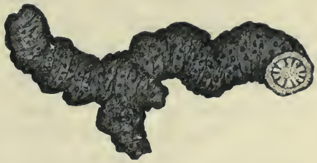


Fig. 115.—*Hydrastis canadensis:* rhizome.

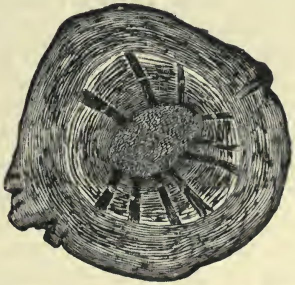


Fig. 116.—Hydrastis rhizome: transverse section, magnified.

fracture short, waxy; internally deep yellow, mostly parenchyma enclosing an interrupted circle of small fibro-vascular bundles; odor distinctive; taste bitter. Powder, brownish-yellow; microscopically —numerous starch grains, .002–.015 Mm. ($\frac{1}{12500}$–$\frac{1}{1650}$′) broad, fragments of tissues with fibro-vascular bundles, tracheæ, short sclerenchymatous fibres, tabular cork cells. *Solvents:* alcohol; diluted alcohol; boiling water. Dose, gr. 5–30 (.3–2 Gm.).

Adulterations.—Rhizomes of *Aristolochia Serpentaria, Aristolochia reticulata, Cypripedium hirsutum, Cypripedium parviflorum, Asarum canadense, Xanthorrhiza apiifolia,* and roots of *Styloph'orum diphyl'lum.*

Commercial.—The Cherokee Indians used hydrastis very early as a domestic remedy and dye, and although they disclosed its value to the American settlers, it did not attract medical attention until 1798, but soon thereafter became popular with the ''Eclectics'' and later one of our important drugs.

Constituents.—Hydrastine 1.5–3.14 p. c., Berberine 3–4 p. c., Canadine (resin, fluorescent compound, starch, sugar, gum, fat, coloring matter), ash 5 p. c.

Hydrastina, Hydrastine, $C_{21}H_{21}NO_6$, *official.*—(Syn., Fr. Hydrastine; Ger. Hydrastin.) This characteristic colorless alkaloid is obtained by adding hydrochloric or sulphuric acid in excess to an alcoholic tincture of hydrastis, whereby the corresponding berberine salt deposits in crystals; to the filtered mother-liquor add ammonia water until acidity is nearly neutralized, strain to remove ammonium salt, concentrate to a syrupy consistence and pour this into 10 volumes of cold water, to remove fat and resin; to the filtrate, containing crude hydrastine salt, add ammonia water in excess to precipitate impure alkaloid, which may be purified by dissolving in diluted sulphuric acid, again precipitating with ammonia water and repeated crystallization from hot alcohol; also prepared synthetically; occurs in white, creamy white, glistening prisms, white microcrystalline powder, permanent, soluble in benzene, alcohol (170), hot alcohol (22), chloroform (1.4), ether (175); insoluble in water; saturated alcoholic solution alkaline, melts at 131° C. (268° F.). *Tests:* 1. With sulphuric acid—yellow color, changing to purple on heating. 2. With sulphuric acid containing .005 Gm. of molybdic acid in each Ml. (Cc.)—green, olive-green, brown; substitute selenous acid for molybdic acid—light green color, changing to brown; with nitric acid—reddish-yellow color; incinerate .1 Gm.—ash non-weighable. *Impurities:* Hydrastinine, berberine. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{4}$–$\frac{1}{2}$ (.016–.03 Gm.).

Hydrastinæ Hydrochloridum, Hydrastine Hydrochloride, $C_{21}H_{21}NO_6.HCl$, *official.*—(Syn., Hydrastin. Hydrochl., Hydrastine Chloride; Fr. Chlorhydrate de Hydrastine; Ger. Hydrastinhydrochlorid.) Obtained by dissolving the pure alkaloid in alcoholic solution of hydrochloric acid, concentrating until crystals appear; occurs as a white, creamy-white powder, odorless, hygroscopic; soluble in water, alcohol, slightly in chloroform, ether; aqueous solution (1 in 20) neutral, slightly acid; with silver nitrate T. S.—white precipitate, insoluble in nitric acid. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{4}$–$\frac{1}{2}$ (.016–.03 Gm.).

Hydrastininæ Hydrochloridum, Hydrastinine Hydrochloride, $C_{11}H_{11}NO_2.HCl$, *official.*—(Syn., Hydrastinin. Hydrochl., Hydrastinine Chloride, Hydrastininæ Hydrochloras; Fr. Chlorhydrate d'Hydrastinine; Ger. Hydrastininhydrochlorid.) This hydrochloride of the artificial alkaloid is obtained by the oxidation of hydrastine with an oxidizing agent (nitric acid, potassium dichromate or permanganate, etc.) in acid solution; dissolve hydrastine 10 Gm. in nitric acid 75 Ml. (Cc.), heat to 60° C. (140° F.), upon cooling opianic acid crystallizes out, add to filtrate potassium hydroxide solution to precipitate hydrastinine, purify by recrystallizing from benzene or acetic ether, dissolve crystals in hydrochloric acid, crystallize from alcohol; occurs in light yellowish needles, yellowish-white, crystalline powder, odorless; soluble in water, alcohol, chloroform (195), ether (1820); aqueous solution (1 in 20) neutral, with blue fluorescence, especially when highly diluted, melts at 210° C. (410° F.) with partial decomposition. *Tests:* 1. Aqueous solution + potassium dichromate T. S.—precipitate, dissolving by gentle heat but separating again in glistening needles on cooling. 2. Aqueous solution + silver nitrate T. S.—white precipitate, insoluble in nitric acid; incinerate .1 Gm.—ash non-weighable. *Impurities:* Hydrastine, foreign alkaloids. Used chiefly for uterine hemorrhage (hypodermically), also as oxytocic; slows heart, but increases force of contraction, motor-depressant, paralyzant. Dose, gr. $\frac{1}{3}$–$\frac{1}{2}$ (.02–.03 Gm.), in 10 p. c. solution.

Berberine, $C_{20}H_{17}NO_4$.—This colored alkaloid is obtained by the preceding process for separating hydrastine; occurs in bitter yellow needles, crystalline powder, soluble in hot water or alcohol; the hot alcoholic solution with iodine gives dark green lustrous scales; forms several yellow salts, carbonate, hydrochloride, phosphate, sulphate, etc., which dissolve in water with difficulty; found also in berberis, calumba, coptis, menispermum, xanthorrhiza, etc. Dose, gr. $\frac{1}{2}$–1 (.03–.06 Gm.).

Canadine, $C_{20}H_{21}NO_4$.—This forms white needles; in alcoholic solution, with iodine get yellow crystals; it is called sometimes tetrahydroberberine, and differs from hydrastine in being more soluble in acetic ether and alcohol; only the hydrochloride and sulphate are easily soluble in alcohol or hot water; the name xanthopuccine once assigned to it, but as such it was very likely impure berberine.

PREPARATIONS.—1. *Extractum Hydrastis.* Extract of Hydrastis. (Syn., Ext. Hydrast., Extract of Golden Seal, Powdered Extract of Hydrastis; Fr. Extrait de Hydrastis; Ger. Hydrastisextrakt.)

Manufacture: Moisten 100 Gm. with alcohol 100 Ml. (Cc.) + tartaric acid .5 Gm., + alcohol to cover; macerate, percolate until exhausted, reclaim alcohol, evaporate residue at 70° C. (158° F.) to soft extract, frequently stirring, add 5 Gm. of a mixture (magnesium oxide 1 + dried starch 3), mix thoroughly, spread thinly on glass or tinned-metal plates, or in porcelain dish, dry in air-bath at 70° C.

(158° F.), pulverize; after assay add enough mixture (magnesium oxide + dried starch) for extract to contain 10 p. c. of ether-soluble alkaloids, mix thoroughly, pass through fine sieve; contains 9–11—10 p. c. of ether-soluble alkaloids; 1 Gm. represents about 4 Gm. of the drug. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. 1–10 (.06–.6 Gm.).

2. *Fluidextractum Hydrastis.* Fluidextract of Hydrastis. (Syn., Fldext. Hydrast., Fluid Extract of Hydrastis, Fluidextract of Golden Seal; Br. Extractum Hydrastis Liquidum; Fr. Extrait fluide d'Hydrastis; Ger. Hydrastisfluidextrakt.)

Manufacture: Similar to Fluidextractum Ergotæ, page 60: 1st menstruum: alcohol 60 Ml. (Cc.), water 20, glycerin 10; 2nd menstruum: 67 p. c. alcohol; reserve first 75 Ml. (Cc.), in which dissolve soft extract, assay and add enough 2nd menstruum for the 100 Ml. (Cc.) to contain 1.8–2.2—2 Gm. of ether-soluble alkaloids. Dose, ♏v–30 (.3–2 Ml. (Cc.)).

3. *Glyceritum Hydrastis.* Glycerite of Hydrastis. (Syn., Glycer. Hydrast., Glycerite of Golden Seal; Fr. Glycéré d'Hydrastis du Canada; Ger. Gilbwurzelglycerit.)

Manufacture: 100 p. c. Macerate, percolate 100 Gm. with alcohol until exhausted, remove nearly all the alcohol by distillation or evaporation, pour thick concentrated liquid into ice-cold water 45 Ml. (Cc.), set aside for 24 hours, filter out resin, pass through filter cold water q. s. 50 Ml. (Cc.); after assay add enough glycerin (50 Ml. (Cc.)) for product to contain 1.12–1.37—1.25 Gm. of ether-soluble alkaloids, mix thoroughly. This is used in injections, sprays, etc., instead of the colorless proprietary preparations on the market. Dose, ♏v–30 (.3–2 Ml. (Cc.)).

4. *Tinctura Hydrastis.* Tincture of Hydrastis. (Syn., Tr. Hydrast., Tincture of Golden Seal; Fr. Teinture d'Hydrastis Canadensis; Ger. Hydrastistinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: 67 p. c. alcohol—percolate 95 Ml. (Cc.), assay, and add enough menstruum for the 100 Ml. (Cc.) to contain .36–.44—.4 Gm. of ether-soluble alkaloids. Dose, ʒss–1 (2–4 Ml. (Cc.)).

Unoff. Preps.: Decoction, 5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)). *Liquor Hydrastinæ Compositus,* hydrastine hydrochloride .3 p. c., +. *Hydrastin* of "Eclectics" is a resinoid, prepared by exhausting the drug with alcohol, evaporating, and precipitating with acidulated (HCl) water; it is chiefly berberine muriate, which often occasions for it the substitution of the pure hydrochloride of that alkaloid, dose, gr. 2–6 (.13–.4 Gm.).

Properties.—Upon digestion, circulation, respiration, and nervous system analogous to, but much milder than, strychnine. Bitter tonic, increases appetite, digestion, gastric secretions (berberine), and the flow of bile; antiperiodic, protoplasmic poison, interfering with the white blood-corpuscle movement, alterative to the mucous membranes, deobstruent to the glandular system, antiseptic, cholagogue, diuretic. Hydrastine acts on the nervous system like quinine, but it is non-toxic, as large doses only produce warmth in the stomach and ringing in the ears.

Uses.—Chronic dyspepsia and cystitis, catarrhs of the stomach, duodenum, gall-ducts, bladder, uterus and vagina, constipation, bronchitis, malaria, intermittent fever, jaundice. Locally in gonorrhœa, leucorrhœa, otorrhœa, gleet, chronic nasal catarrh and pharyngitis, syphilitic sores in the mouth, nares, and throat, unhealthy intractable ulcers and sores, cancers, fistulas, hemorrhoids, fissured nipples, conjunctivitis, tonsillitis, hemorrhage. Hydrastine for chronic malaria is much weaker, but next in value to quinine; hydrastinine (hypodermically) for menorrhagia and metrorrhagia. The yellowish liquids are objectionable owing to their staining qualities, for which, however, the Indians valued them in dyeing fabrics yellow; with indigo they impart a fine green to wool, silk, and cotton.

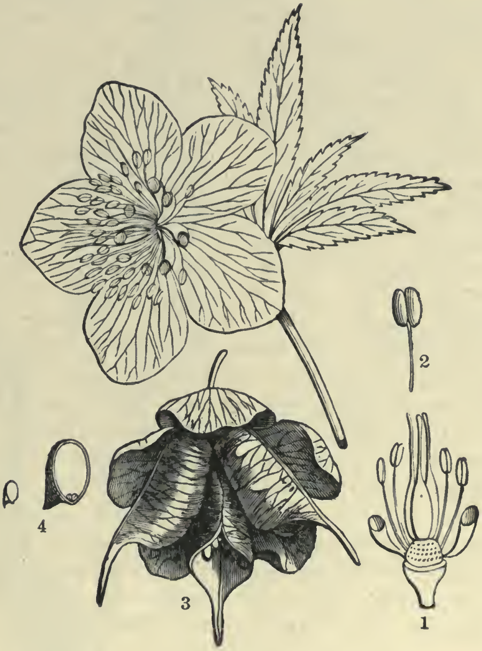


Fig. 117.—*Helleborus viridis:* *1*, receptacle, tricarpelled ovary, and stamens; *2*, a stamen; *3*, the three resulting ripened fruits; *4*, a seed.

Poisoning: Same as for nux vomica and strychnine.

Incompatibles: Alkalies, mineral acids, tannic and other vegetable acids, hydrated chloral, potassium bromide, motor depressants.

Synergists: Quinine and the vegetable tonics upon the stomach, ergot upon the uterus, and strychnine upon the spinal cord.

Allied Plants:

1. *Helleb'orus ni'ger, Black Hellebore.*—The dried rhizome and roots, official 1820–1880; C. and S. Europe, mountains. Acaulescent perennial, leaves evergreen, 7–9-lobed, flowers rose-like. Rhizome knotty,

5 Cm. (2′) long, 12 Mm. (½′) thick, blackish, bark thick, wood-wedges 8, medullary rays broad, taste sweet, bitter, usually from Germany; contains helleborin, helleborein, helleboretin, resin, volatile oil, fixed oil, gum, etc. Heart stimulant, drastic hydragogue cathartic, alterative; used for melancholia, mania, dropsy, amenorrhœa, epilepsy, skin troubles; in decoction, infusion, tincture, extract. Dose, gr. 5–20 (.3–1.3 Gm.).

2. *H. fœ′tidus, Bear's Foot.*—The leaves, official 1820–1840; Europe. Perennial herb—the most energetic of the genus. Used for asthma, hysteria, hypochondriasis, tænia; in powder, decoction, syrup. Dose, gr. 5–20 (.3–1.3 Gm.). *H. vir′idis, Green Hellebore.* The rhizome (root), United States, Europe; rhizome about the same as *H. niger*, but has only 4 wood-wedges, and is smaller.

3. *Ado′nis verna′lis, False Hellebore.*—N. Europe, Asia. Plant 25 Cm. (10′) high, leaves light green, pinnatifid, flowers yellow; contains chiefly *adonidin* (adonin), an intensely bitter, yellow, hygroscopic glucoside, soluble in water, alcohol. Cardiac stimulant, mild diuretic; resembles digitalis, but is more prompt, non-cumulative; mitral and aortic regurgitation, precordial pain, dyspnœa. Dose, gr. 1–2 (.06–.13 Gm.); fluidextract (75 p. c. alcohol); adonidin, gr. $\frac{1}{16}$–$\frac{1}{3}$ (.004–.02 Gm.).

4. *Cop′tis trifo′lia, Gold thread.*—The rhizome (root), official 1820–1880, N. America. Plant with scape 7.5–12.5 Cm. (3–5′) high, leaves radical, 3-foliate, flowers May, whitish. Rhizome golden-yellow, filiform, fruit 7 follicles with black seeds, inodorous, bitter; contains berberine, coptine (white, possibly identical with hydrastine), resin. Used for ulcerated mouth; in infusion, decoction, fluidextract (dil. alc.), tincture (10 p. c.). Dose, gr. 15–60 (1–4 Gm.).

5. *Xanthorrhi′za apiifo′lia, Shrub Yellow-Root.*—The rhizome and roots, official 1820–1880; S. and C. United States. Shrub .6–1 M. (2–3°) high, stem clustered, 6 Mm. (¼′) thick, wood yellow, leaves compound, flowers April, purple, racemes, rhizome .6–1 M. (2–3°) long, 12 Mm. (½′) thick, yellowish internally and externally, bitter; contains berberine, resin, starch, gum, etc. Used as a tonic like calumba or quassia; in infusion, decoction, tincture. Dose, ʒss–1 (2–4 Gm.).

CIMICIFUGA. CIMICIFUGA.

Cimicifuga racemosa, *(Linné) Nuttall.*	The dried rhizome and roots, with not more than 2 p. c. of stems, foreign matter.

Habitat. United States, Canada; in shady, rocky places.

Syn. Cimicif., Black Cohosh, Black Snakeroot, Macrotys, Bugbane, Bugwort, Rattleroot, Rattleweed, Richweed, Squawroot, Rattlesnake's Root; Cimicifuga Rhizoma, Actææ Racemosæ Radix; Fr. Racine d'Actée à Grappes; Ger. Schwarze Schlangenwurzel.

Cim-i-cif′u-ga. L. *cimex*, bug, + *fugare*, to drive away—*i. e.*, from the fact of *Cimicifuga fœtida* being used for that purpose in Siberia and Kamtchatka.

Ra-ce-mo′sa. L. *racemosus*—*i. e.*, full of clusters, racemes—*i. e.*, the flowers.

Plant.—Perennial; stem slender, unbranched, 1.5–2.5 M. (5–8°) high; leaves irregularly ternately decompound, the rather small leaflets incised, 2.5–7.5 Cm. (1–3′) long; flowers June–July, regular, numerous, small, white, in wand-like racemes, 20–50 Cm. (8–20′) long, emit disagreeable odor. Rhizome, horizontal in growth, branched, 2–12 Cm. ($\frac{4}{5}$–5′) long, 1–2.5 Cm. ($\frac{2}{5}$–1′) thick, dark brown, grayish-black, slightly annulate from circular scars of bud scale-leaves; upper surface with numerous stout, erect, curved branches terminated by deep cup-shaped scars showing radiate structure; lower and lateral surfaces with numerous root-scars and few short roots; fracture horny; internally whitish and mealy or dark brown and waxy; bark thin, wood distinctly radiate and of same thickness as pith; odor slight; taste bitter, acrid; roots cylindrical, obtusely quadrangular, 1–3 Mm. ($\frac{1}{25}$–$\frac{1}{8}$′)

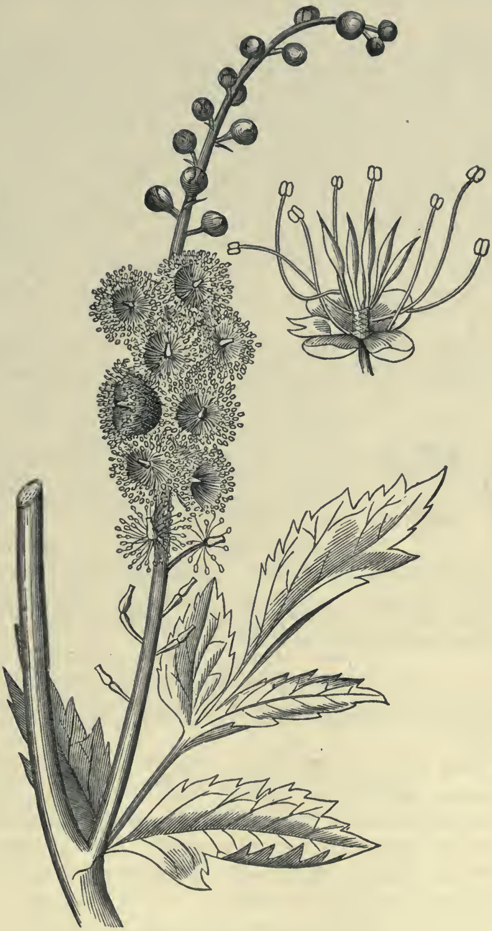


Fig. 118.—*Cimicifuga racemosa.*

thick, brownish, blackish, longitudinally wrinkled, fracture short; internally bark brownish, wood yellowish, 4–6-rayed. Powder, light brown; microscopically—numerous starch grains, .003–.015 Mm. ($\frac{1}{8325}$–$\frac{1}{1650}$′) broad, fragments showing tracheæ with bordered pores and lignified wood-fibres, fragments of suberized epidermis made up of tabular cells. *Solvents:* alcohol; boiling water. Dose, gr. 5–30 (.3–2 Gm.).

Adulterations.—Rare: Caulophyllum, podophyllum, each sometimes 1 p. c., comfrey, possessing similar blackish color, smaller amount.

Commercial.—Plant, also named *Actæ'a racemosa,* emits when in bloom an odor resembling meadow-sweet, by many considered unpleasant. Rhizome should be collected in autumn (most active), and used shortly thereafter, as it deteriorates with age; recognized readily by the microscope from black and green hellebore whose rhizomes have few and broad wood-bundles and roots with pentagonal or hexagonal wood-zone; rhizome of *Actæa spica'ta,* Europe, very similar, but its juicy berries are in marked contrast with the official plant's dry follicles.

Constituents.—Cimicifugin, resins 3.5 p. c., amorphous resinous body (probably the active principle), fat, starch, gum, tannin, volatile oil, sugar; ash 8–10 p. c.; latest investigators claim activity to depend upon: isoferulic acid, salicylic acid, palmitic acid, phytosterol, 3 crystalline bodies (alcohols ?), alkaloids (trace).

Cimicifugin.—Bitter, acrid crystalline principle, obtained by acting on the "Eclectic" resinoid, cimicifugin, or upon the fresh rhizome with alcohol, precipitating (resin, tannin, coloring matter) with lead subacetate, removing lead with hydrogen sulphide, and evaporating; it is soluble in alcohol, chloroform, slightly in ether.

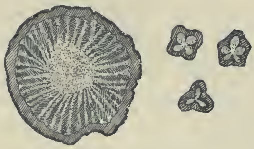


Fig. 119.—*Cimicifuga racemosa:* transverse section through a branch of the rhizome and through rootlets; natural size.

Resins.—There are two of these, one soluble in alcohol but not in ether, the other soluble in ether as well as alcohol. These two are obtained as a mixture by exhausting powdered drug with alcohol, precipitating with water, drying precipitate, and as such constitutes the "Eclectic" *cimicifugin* (*macrotin*), a yellowish-brown hygroscopic powder. Dose, gr. ½–2 (.03–.13 Gm.).

Preparations.—1. *Extractum Cimicifugæ.* Extract of Cimicifuga. (Syn., Ext. Cimicif., Powdered Extract of Cimicifuga, Extract of Black Cohosh; Fr., Extrait d'Actée à Grappes; Ger. Cimicifugaextrakt.)

Manufacture: Macerate, percolate 100 Gm. with alcohol until exhausted, reclaim alcohol, evaporate residue at 70° C. (158° F.) to dryness, frequently stirring; add dried starch q. s. 25 Gm., pulverize, mix thoroughly, pass through fine sieve. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. 1–8 (.06–.5 Gm.).

2. *Fluidextractum Cimicifugæ.* Fluidextract of Cimicifuga. (Syn., Fldext. Cimicif., Fluid Extract of Cimicifuga, Fluidextract of Black Cohosh, Fluidextract of Black Snakeroot; Extractum Cimicifugæ Liquidum; Fr. Extrait fluide d'Actée à Grappes; Ger. Cimicifuga-fluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: alcohol. Dose, ♏v–30 (.3–2 Ml. (Cc.)).

Unoff. Preps.: Decoctum, 5 p. c., dose, ℥ss–1 (15–30 Ml. (Cc.)). *Compound Syrup*, 4 p. c. (+ glycyrrhiza 2, senega 2, ipecac 1, wild cherry 4), purified talc 1.5, sugar 65, water q. s. 100, dose, ʒj–4 (4–15 Ml. (Cc.)). *Tincture*, 20 p. c. (alcohol), dose, ʒss–1 (2–4 Ml. (Cc.)).

PROPERTIES.—Alterative (diuretic, diaphoretic, expectorant), antispasmodic, sedative (arterial and nervous), safer than digitalis, emmenagogue. It acts on the gastric secretion like any other bitter, slightly depresses the rate, but increases the force of the pulse, like digitalis; contracts the uterus, increasing the menstrual flow and arterial tension.

USES.—It was introduced first into medicine in 1831 by Dr. Young. Given as cardiac tonic in fatty heart, chorea, acute and chronic bronchitis, rheumatism, neuralgia, hysteria, phthisis, dyspepsia, amenorrhœa, dysmenorrhœa, seminal emissions. Large doses cause vertigo, tremors, reduced pulse, vomiting, prostration. Once, but not now, thought efficacious in snake bite, labor-pains, and ills of late pregnancy.

Incompatibles: Iron preparations, stimulants, alcohol, ammonia.

Synergists: Gold, digitalis, ergot, belladonna, etc.

STAPHISAGRIA. STAPHISAGRIA.

Delphinium Staphisagria, *Linné.* { The ripe seeds, with not more than 2 p. c. of foreign vegetable matter.

Habitat. Mediterranean Basin; cultivated, France, Italy.

Syn. Staphisag., Stavesacre, Larkspur Herb, Semen Staphidis-agriæ, Semen Pedicularis; Br. Staphisagriæ Semina; Fr. Staphsaigre; Ger. Stephanskörner, Läusekörner.

Del-phin'i-um. Gr. δελφίν(ιον); L. *delphinus*, a dolphin—*i. e.*, the form of the nectary resembles the imaginary figures of the dolphin.

Staph-i-sag'ri-a. L. fr. Gr. σταφίς, dried grape, raisin, + ἀγρία, wild—*i. e.*, fruit clusters resemble wild grapes. *Staves'acre*—simply a corruption.

PLANT.—Annual herb 1–1.3 M. (3–4°) high, branched, downy; root large, tapering; leaves 10–12.5 Cm. (4–5′) broad; palmately 5–9 parted, with long, hairy petioles, lanceolate, pubescent segments; flowers purplish, racemes; pedicels long, stout, hairy; sepals petaloid; fruit 3, thick, oblong, erect, hairy, veined follicles with prolonged curved beak, each follicle 12-seeded, odor of plant unpleasant. SEEDS, irregularly triangular, flattened, somewhat tetrahedral, one side convex, 4–7 Mm. ($\frac{1}{6}$–$\frac{1}{4}$′) long, 3–6 Mm. ($\frac{1}{8}$–$\frac{1}{4}$′) broad, dark brown, grayish, lighter with age, coarsely reticulate, easily cut showing light brown oily endosperm, enclosing small embryo at pointed end, odor slight, disagreeable; taste intensely bitter, acrid. POWDER, grayish-black, brownish; microscopically—thin-walled parenchyma cells, thick-walled cells, polygonal endosperm cells enclosing small aleurone grains and fixed oil, the latter forming in large globules with hydrated chloral T. S. *Solvents:* alcohol; boiling water. Dose, gr. 1–2 (.06–.13 Gm.).

Constituents.—Alkaloids 1 p. c.: Delphinine, Delphinoidine, Delphisine, Staphisagrine, Staphisagroine, $C_{20}H_{24}NO_4$, malic acid, fixed oil 25 p. c., volatile oil, resin, (proteids, mucilage, ash 9 p. c.).

Delphinine, $C_{22}H_{35}NO_6$.—This leading alkaloid occurs as malate in white acrid crystals and is obtained by boiling the decoction with magnesium oxide, treating precipitate with alcohol, evaporating. As such it consists of three distinct principles, one of resinous nature, separated from its solution in diluted sulphuric acid by adding nitric acid; another which is insoluble in ether (staphisagrine—staphisaine); the third soluble in alcohol, chloroform, ether, and considered pure delphinine. Dose, gr. $\frac{1}{60}$–$\frac{1}{10}$ (.001–.006 Gm.); made into *ointment*, 5 p. c., and *liniment*, 5 p. c. with alcohol or olive oil as the base.

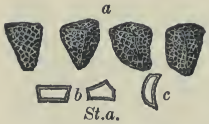


Fig. 120.—Stavesacre seed: *a*, natural size; *b*, cross-section; *c*, longitudinal section.

Delphinoidine, $C_{42}H_{68}N_2O_7$.—Amorphous, alkaline, soluble in alcohol, chloroform, ether; brownish-red with sulphuric acid.

Delphisine, $C_{27}H_{46}N_2O_4$.—Crystalline, soluble in alcohol, chloroform, ether; dark brown with sulphuric acid.

Staphisagrine (Staphisaine, Staphisain), $C_{22}H_{33}NO_5$.—Amorphous, yellow, insoluble in ether, soluble in alcohol, chloroform; bitter, acrid, red and violet with sulphuric acid.

The fixed oil is extracted with ether or benzene, which also takes out delphinine at the same time. It is claimed that delphinine and delphisine have the same composition, $C_{31}H_{49}NO_7$, and that they crystallize alike from their ether or benzene solutions.

Preparations.—1. *Fluidextractum Staphisagriæ.* Fluidextract of Staphisagria. (Syn., Fldext. Staphisag., Fluid Extract of Staphisagria, Fluidextract of Stavesacre (Seed); Fr. Extrait fluide des Semences de Staphisaigre; Ger. Stephanskörnerfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: alcohol; remove oil, which soon separates, by chilling and filtering through a filter moistened with alcohol. Dose, ♏j–2 (.06–.13 Ml. (Cc.)).

Unoff. Preps.: Extract, dose, gr. $\frac{1}{4}$–1 (.016–.06 Gm.). *Tincture,* 10 p. c., dose, ♏v–15 (.3–1 Ml. (Cc.)). *Unguentum Staphisagriæ* (Br.), 20 parts + yellow wax 10, benzoinated lard, 85.

Properties.—Sedative, emetic, cathartic, diuretic, irritant, parasiticide, poisonous.

Uses.—The seeds were popular with the Greeks, Romans, etc., as emetic, cathartic, but are so dangerous as, in modern times, to be used chiefly externally for killing vermin, lice, itchmite; in rheumatism, neuralgia, earache, toothache, and for catching fish like cocculus indicus; they should never be applied to abrasions. When taken internally cause lessened heart action and respiration, great weakness, loss of voluntary movement, then insensibility, frequent spasms, death from spinal-cord and respiratory paralysis (asphyxia). Delphinine resembles closely aconitine and veratrine, irritating the skin, producing tingling and burning inflammation, even when applied as ointment or liniment.

Poisoning: Similar to aconite and veratrum viride; use emetics or pump, draughts of warm water, tannin, powdered charcoal, diffusible stimulants, strychnine, atropine, artificial respiration, keep patient quiet, feet elevated, extremities warm. To relieve spasms, inhale chloroform or give hydrated chloral (ʒss; 2 Gm.), potassium bromide (ʒj–2; 4–8 Gm.). Use all haste, as death is chiefly by asphyxia.

Allied Plants:

1. *Delphinium Consol'ida, Field Larkspur.*—The seed, official 1820–1880; C. Europe, cultivated and naturalized in the United States. Plant .6–1 M. (2–3°) high, in grain fields, flowers beautiful blue, seed flattish, tetrahedral, 1–2.5 Mm ($\frac{1}{25}$–$\frac{1}{10}$′) broad, acute edges, testa black, pitted, inodorous, bitter, acrid; contains 3 alkaloids; used for asthma, dropsy, wounds, ulcerated buboes; in tincture, 10 p. c. (alcohol), fluidextract or decoction; poisonous. *D. Aja'cis*, S. Europe, *D. urceola'tum* (*exalta'tum*), Penn., Minn., *D. carolinia'num* (*azu'reum*), Wis., Ark.—The first has the most dense flowers, the second the greatest height, the third the lightest blue flowers; all three are cultivated.

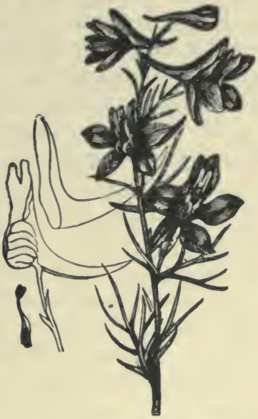


FIG. 121.—*Delphinium Consolida.*

ACONITUM. ACONITE.

Aconitum Napellus, *Linné.* The dried tuberous root, with not more than 5 p. c. of stems, foreign matter, containing .5 p. c. of ether-soluble alkaloids.

Habitat. Europe, Asia, N. America, Himalaya, Alps, Pyrenees Mountains, 3,300–4,800 M. (11,000–16,000°) elevation; cultivated in England, C. Europe.

Syn. Aconit., Aconite Root, Monkshood, Wolfsbane, Cuckoo's or Friar's Cap, Friar's Cowl, Wolfroot, Styrian Monkshood, Mousebane, Face-in-hood, Jackob's-chariot, Blue-rocket; Br. Aconiti Radix; Fr. Aconit Napel, Coqueluchon; Ger. Tubera Aconiti, Eisenhutknollen, Sturmhut.

Ac-o-ni'tum. L. fr. Gr. ἐν, on, + ἀκόναις, rock—*i. e.*, it grows upon steep rocks in mountains; or fr. Fr. *Acone*, a town in Bithynia, where it grows plentifully.

Na-pel'lus. L. a little turnip; fr. *napus*, a turnip—*i. e.*, mediæval name from shape of roots, once used generically.

PLANT.—Perennial herb; stem .6–1.5 M. (2–4°) high, round, smooth, leafy; leaves 5–10 Cm. (2–4′) broad, palmately 3–7 divided, dark green above, lighter below, smooth, shining, petiolate, divisions wedge-shaped, with 2–3 lobes extending midway; flowers July (third year), large, beautiful, violet-blue, on stem's summit, racemes, sepals petaloid, nectariferous; fruit, 3–5 pod-like capsules. ROOT, produced at the end of a short rhizome, conical, fusiform, 4–10 Cm. ($1\frac{3}{5}$–4′) long, 1–2 Cm. ($\frac{2}{5}$–$\frac{4}{5}$′) thick at crown; grayish-brown, smooth or longitudinally wrinkled, upper end with a bud, remains of bud-scales or stem-scars, other portions with many root-scars or short rootlets; fracture short, horny, mealy; internally, bark brownish, 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, cambium zone 5–8-angled with a small fibro-vascular bundle in each angle; pith whitish, 2–7 Mm. ($\frac{1}{12}$–$\frac{1}{4}$′) broad; odor very slight; taste sweetish, acrid, developing tingling sensation, numbness. POWDER, grayish-brown; microscopically—numerous, spherical (plano-convex) starch grains, .003–.015 Mm. ($\frac{1}{8325}$–$\frac{1}{1650}$′) broad, tracheæ, stone cells tabular, irregular, fragments of cork (few) and parenchyma (many), stem bast-fibres (few, long). *Solvent:* alcohol. Dose, gr. 1–2 (.06–.13 Gm.).

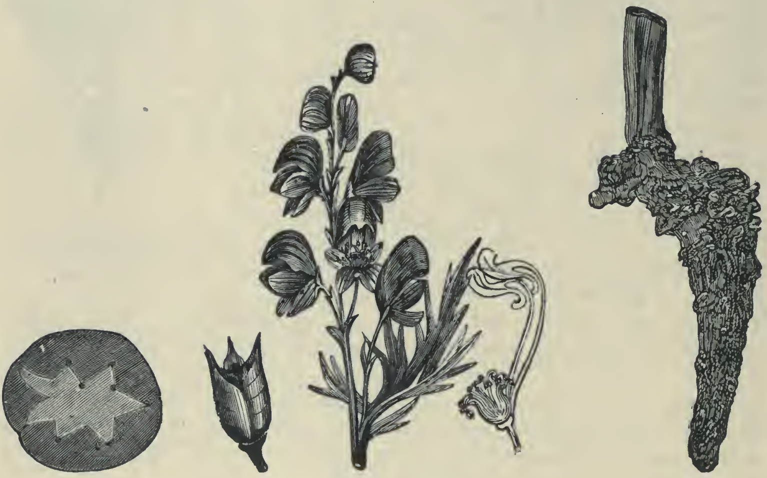


FIG. 122.—*Aconitum Napellus: a*, transverse section of tuber; *b*, fruit carpels; *c*, flowering branch; *d*, flower deprived of calyx, showing the only 2 peculiarly shaped petals, the 6 others almost aborted; *e*, tuber.

ADULTERATIONS.—Allied aconite roots (*A. variegatum*—much smaller, *A. Fischeri*—light gray, plump, smooth), defective roots, small horseradish roots (collected only when leaves absent, as by these they may easily be distinguished), yellowish externally, taste exceedingly pungent, irritating; roots of European Masterwort (*Imperato'ria* (*Peuced'anum*) *Ostru'thium*), which closely resemble aconite root, but are aromatic, pungent, with oil-cells arranged in several circles, easily visible in cross-sections.

Commercial.—Plant grows wild, but under cultivation becomes slightly stronger, owing to which the Br. P. recognizes alone its root collected in autumn; all parts are very poisonous, a fact even known to the ancients, and was not introduced into medicine until 1762 (Baron Störck, Vienna); it is grown in gardens for ornamental flowers and when these have expanded, thereby insuring identity, the root should be collected. Imported mostly from Germany (England, France, Switzerland, India) in packages, bales, etc.

CONSTITUENTS.—Four alkaloids (one crystalline, three amorphous) .24–.62–1.15 p. c.: Aconitine (crystalline), Picraconitine (benzaconine, isaconitine), $C_{25}H_{39}NO_{11}$, Aconine, Pseudaconitine (napelline), $C_{33}H_{45}NO_{12}$, aconitic acid, $H_3C_6H_3O_6$, starch, resin, fat, sugar, mannite.

Aconitina, Aconitine, $C_{34}H_{47}NO_{11}$, *official.*—(Syn., Aconitin., Napaconitine, Aconitia; Fr. Aconitine; Ger. Aconitin.) Exists in combination with aconitic acid, and is obtained by exhausting root with cold rectified fusel oil, shaking resulting tincture with diluted (1 p. c.) sulphuric acid, adding chloroform to remove resin, rendering alkaline with sodium carbonate, shaking out with ether. It is in colorless (white) rhombic tables or prisms, odorless, permanent, producing tingling and numbing sensation to tongue, lips—taste cautiously even when diluted; soluble in alcohol (28), ether (65), benzene (7), slightly in water, almost insoluble in petroleum benzin; solutions alkaline; melts at 195° C. (383° F.); forms salts, as hydrochloride, nitrate, sulphate, etc.; commercial aconitine occurs in amorphous and crystalline forms, but the latter should alone be used, as the former contains derivatives lessening its activity 10–15 p. c. *Tests:* 1. Dissolve .001 Gm. with 2–3 drops of nitric or sulphuric acid on white porcelain surface—colorless solution; with 2 drops of sulphuric acid containing .005 Gm. of ammonium vanadate in each Ml. (Cc.)—orange solution. 2. Dilute solutions, + mercuric potassium iodide T. S., or + tannic acid T. S., or + gold chloride T. S.—precipitate; concentrated solutions, + platinic chloride T. S., or + mercuric chloride T. S., or + picric acid T. S.—precipitate; incinerate .05 Gm.—ash non-weighable. 3. Evaporate a solution of .01 Gm. with 5 drops of fuming nitric acid, cool resulting yellow residue, + alcoholic potassium hydroxide T. S.—not violet (abs. of pseudaconitine, atropine). Dose (crystals), gr. $\frac{1}{640}$–$\frac{1}{200}$ (.0001–.00035 Gm.; (amorphous), gr. $\frac{1}{64}$–$\frac{1}{20}$ (.001–.003 Gm.).

Aconine, $C_{26}H_{41}O_{11}$.—This appears antagonistic to aconitine in cardiac effect; picraconitine is considered inert; aconitic acid is abundant, but is chiefly in combination with calcium, and is almost inert.

PREPARATIONS.—1. *Extractum Aconiti.* Extract of Aconite. (Syn., Ext. Aconit., Powdered Extract of Aconite, Extract of Aconite Root; Fr. Extrait de Racine d'Aconit; Ger. Eisenhutknollenextrakt.)

Manufacture: Moisten 100 Gm. with alcohol 50 Ml. (Cc.) + tartaric acid .5 Gm., + alcohol enough to saturate and cover; macerate, percolate until exhausted, reserve first 100 Ml. (Cc.), and reclaim alcohol from second percolate until residue in still is 10 Ml. (Cc.), to which add first reserve and distil until residue of syrupy consistence; transfer to a flask, rinse still with little warm alcohol, which add to flask, cool, shake thoroughly twice with purified petroleum benzin

25 Ml. (Cc.), discard benzin layers; transfer syrupy residue to a dish, rinse flask with warm alcohol 2 Ml. (Cc.), which add to dish, thoroughly incorporate dried starch 5 Gm., evaporate on water-bath, frequently stirring, and when thick spread on glass plates, dry in air-bath at 70° C. (158° F.); pulverize; after assay add enough dried starch for extract to contain 2 p. c of ether-soluble alkaloids; mix thoroughly, pass through fine sieve; contains 1.8–2.2—2 p. c. of ether-soluble alkaloids. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. $\frac{1}{6}$–$\frac{1}{3}$ (.01–.02 Gm.).

2. *Fluidextractum Aconiti.* Fluidextract of Aconite. (Syn., Fldext. Aconit., Fluid Extract of Aconite; Fr. Extrait fluide (de Racine) d'Aconit; Ger. Akonitknollenfluidextrakt.)

Manufacture: Divide 100 Gm. into 3 parts (50, 30, 20), macerate, percolate part 1 (50) with 75 p. c. alcohol, reserve first 20 Ml. (Cc.), continue to 150 Ml. (Cc.), collected in 5 equal portions; with 1st of these moisten part 2 (30), macerate, percolate with remaining 4 portions successively, and, if insufficient, use some original menstruum; reserve first 30 Ml. (Cc.), continue to 80 Ml. (Cc.), collected in 4 equal portions; with 1st of these moisten part 3 (20), macerate, percolate with remaining 3 portions successively, and, if insufficient, use some original menstruum, collect 42 Ml. (Cc.) of percolate, mix with 2 reserved portions; after assay add enough menstruum for the 100 Ml. (Cc.) to contain .45–.55—.5 Gm. of ether-soluble alkaloids. Dose, ♏ss–2 (.03–.13 Ml. (Cc.)).

3. *Tinctura Aconiti.* Tincture of Aconite. (Syn., Tr. Aconit.; Fr. Teinture de Racine d'Aconit; Ger. Akonittinktur, Eisenhuttinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: 70 p. c. alcohol—percolate 95 Ml. (Cc.), assay, and add enough menstruum for the 100 Ml. (Cc.) to contain .045–.055—.05 Gm. of ether-soluble alkaloids; this is considered the best preparation for internal use. Dose, ♏ss–10 (.03–.6 Ml. (Cc.)).

Unoff. Preps.: Abstract (alcohol), dose, gr. $\frac{1}{4}$–1 (.016–.06 Gm.). *Extract* (alcohol), dose, gr. $\frac{1}{6}$–$\frac{1}{3}$ (.01–.02 Gm.). *Fleming's Tincture Aconite Root,* 70 p. c. (alcohol), dose, ♏ss–4 (.03–.26 Ml. (Cc.)). *Liniment of Aconite and Chloroform,* 4.5 p. c. (fldext.), chloroform 12.5, alcohol 8, soap liniment 75. *Linimentum Aconiti* (Br.), 50 Gm. + camphor 3 Gm., alcohol q. s. 100 Ml. (Cc.). *Oleate of Aconitine,* 2 p. c. *Tincture Aconite Leaves,* 8 p. c. (diluted alcohol), dose, ♏j–6 (.06–.4 Ml. (Cc.)). *Unguentum Aconitinæ* (Br.), 2 p. c. *Glycerite. Plaster.* Pseudaconitine (*A. ferox*), dose, gr. $\frac{1}{250}$–$\frac{1}{100}$ (.00026–.00065 Gm.).

PROPERTIES.—Sedative (heart and nerve), anodyne, diaphoretic, antipyretic, myotic, poisonous. Produces tingling and numbness of the lips, mouth, and fingers; increases the secretion of the kidneys, salivary glands, and skin; circulation (heart action, pulse) becomes weak and slow, due to direct depression of heart-muscle, and stimulation of pneumogastric nerve; respiration (breathing) shallow and slow; temperature is lowered, all causing a tendency to fainting when in the erect position, and giving rise to its popular name "therapeutic lancet;" it paralyzes first the sensory and then the motor nerves.

USES.—It should never be given in asthenic or debilitated conditions, or when the heart action is weak, or in gastric catarrh, but may be employed in all sthenic or inflammatory fevers of the young and vigorous; croup, laryngitis, pharyngitis, tonsillitis, acute meningitis, peritonitis, pleuritis, rheumatism; measles, scarlet fever, erysipelas, first stage of pneumonia, pericarditis and pleurisy, nervous heart palpitation, cardiac hypertrophy. Locally on non-abraded surfaces; neuralgia, rheumatism, sciatica, herpes zoster, chilblains, pruritus, odontalgia, periodontitis, inflamed pulps.

Poisoning: Have anxious countenance, pallid, clammy skin covered with cold sweat; pulse and respiration slow, weak, and irregular; muscular weakness, loss of sight and hearing, pupils either normal, contracted or dilated, general anæsthesia, collapse, death from syncope, or respiratory paralysis, sometimes preceded by convulsions; conscious until near the end, when carbon dioxide narcosis sets in. Evacuate stomach reclining, direct recumbent position, feet elevated, warmth to extremities, give diffusible cardiac stimulants (brandy, whisky, alcohol, ether, ammonia) by the stomach, rectum, or skin, then digitalis, tannin; artificial heat and respiration (rhythmically raising and lowering arms from straight at sides to up over head and back again 20 times per minute), amyl nitrite, atropine, and strychnine (hypodermically) to stimulate heart and respiration.

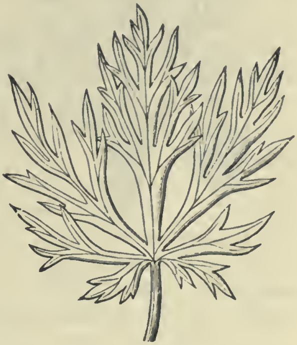


FIG. 123.—*Aconitum Napellus:* leaf, small sized.

Incompatibles: Ammonia, alcohol, alkalies, atropine, digitalis, ether, morphine, heat, turpentine.

Synergists: Veratrum viride, pulsatilla, staphisagria, cold, fatigue.

Leaves, official 1820–1880. These are considered 5–20 times weaker than the root, yet many specimens yield considerable alkaloids; their uncertainty and deception have led to disuse; but if collected when flowers are two-thirds in bloom they are reliable; it is then that all nutrient constituents are in demand for the perfection of reproductive organs, thus leaving behind in the leaves a goodly quantity of the (waste products) alkaloids. Dose, gr. 1–4 (.06–.26 Gm.).

Allied Plants:

1. *Aconitum neomonta'num.*—Leaves, official 1820–1840, and *A. panicula'tum,* leaves, official 1840–1850, possess very little acridity, but even now their roots are collected and mixed with the official.

2. *A. Cam'marum* (*variega'tum*).—Europe; root globular, ovate, 12 Mm. ($\frac{1}{2}'$) long, pith rays 5, short, rounded; and *A. Störckia'num,* Europe; root conical, slender, pith roundish pentagonal, similar in effect, smaller than, but often found mixed with, the official.

3. *A. fer′ox.*—India aconite (native Bikh or Bish) is the strongest species, with root 5–10 Cm. (2–4′) long, 2.5 Cm. (1′) thick, conical and brown; yields pseudaconitine (peraconitine), similar to and as active as aconitine; *A. uncina′tum* and *A. lu′ridum* roots are collected with this, as they all have constituents similar to the official, but here pseudaconitine predominates.

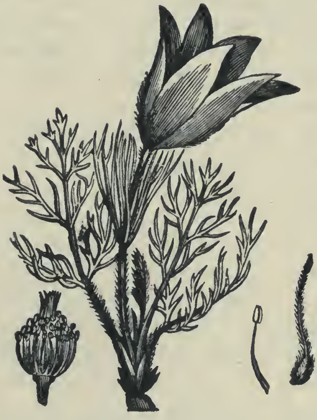


Fig. 124.—*Pulsatilla (Anemone) Pulsatilla.*

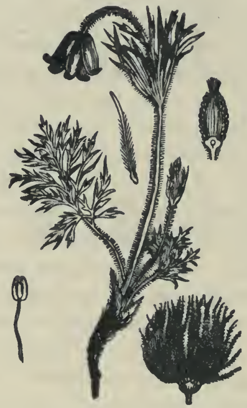


Fig. 125.—*Pulsatilla (Anemone) pratensis.*

4. *A. Fisch′eri* and *A. japon′icum, Japanese* and *Chinese Aconite.*—Roots napiform, long, pith circular, 5–7-rayed; yields japaconitine, identical with aconitine; allied to former is *A. columbia′num;* Rocky Mountains; poisonous. *A. heterophyl′lum,* India—fusiform, conical, bitter, not acrid or poisonous, *A. Antho′ra,* Europe—fusiform, long, pith thin, rays short and long, and *A. Lycoc′tonum,* Europe, N. Asia—rhizome oblique, several-headed, bitter.

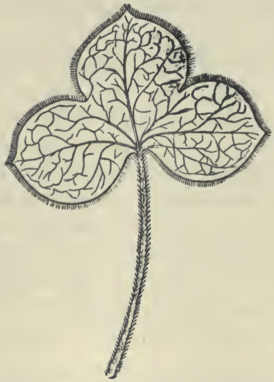


Fig. 126.—*Hepatica Hepatica (triloba)*: leaf showing venation.

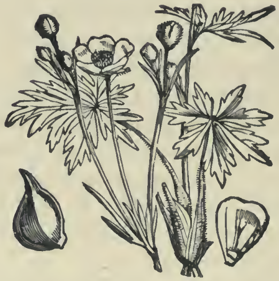


Fig. 127.—Ranunculus in bloom.

5. *Pulsatil'la* (*Anem'one*) *Pulsatilla* and *Pulsatilla* (*Anemone*) *praten'sis, Pulsatilla.*—The herb, collected soon after flowering, official 1880–1900; Europe (England, Siberia). Perennial herbs, 10–25 Cm. (4–10′) high, covered with soft, silky hairs; stems erect, simple, scape bearing a large terminal, bell-shaped, purplish flower having 6 sepals, 2.5–4 Cm. (1–$1\frac{3}{5}$′) broad; fruit achene, numerous, short-beaked; root, several-headed; leaves radical, pinnately-cleft; inodorous, very acrid, and owing to volatility of anemonin (chief constituent) should not be kept longer than one year; contains anemonin, acrid anemone camphor, iso-anemonic acid, $C_{15}H_{14}O_7$. Sedative, anodyne, mydriatic, diuretic, diaphoretic, emmenagogue, expectorant, vesicant, emetic, poisonous—similar to aconite, causing tingling, numbness, reducing respiration, temperature, cardiac and arterial tension, paralysis of motion and sensation; dysmenorrhœa, bronchitis, asthma, whooping-cough, gastritis, epididymitis, orchitis, conjunctivitis, eczema, ulcers, meningitis. *Poisoning*: Symptoms and treatment similar to aconite. Dose, gr. 1–5 (.06–.3 Gm.; extract (expressed juice + alcohol, gr. $\frac{1}{2}$–3 (.03–.2 Gm.); tincture, 50 p. c., ♏$\frac{1}{10}$–10 (.006–.6 Ml. (Cc.)); Homeopathic tincture (extract); anemonin, gr. $\frac{1}{4}$–$\frac{3}{4}$ (.016–.05 Gm.). *P. hirsutis'sima* (*Anemone pa'tens* var. *Nuttallia'na*); herb, official 1880–1890, W. N. America; flowers whitish, purplish, sepals 5–7,—2.5–4 Cm. (1–$1\frac{3}{5}$′) long, developed before the leaves. *A. quinquefo'lia* (*nemoro'sa*), *Wood Flower, Wood Anemone*, N. America; flowers purplish-white, *A. corona'ria, A. sylves'tris*, and *A. ranunculoi'des*, Levant, Asia, Europe; all are acrid and deteriorate upon drying.

6. *Hepat'ica Hepatica* (*tri'loba*), *Noble Liverwort.*—The leaves, official 1830–1880, N. America, Europe. One of our earliest harbingers of spring; acaulescent perennial, flowers, April, bluish, leaves reniform, 5 Cm. (2′) long, 3-lobed; contains mucilage, tannin. Used as tonic, demulcent, deobstruent, for liver affections, bronchitis, phthisis; in decoction, infusion. Dose, ʒss–2 (2–8 Gm.).

7. *Ranun'culus bulbo'sus, Bulbous Buttercup.*—The corm and herb, official 1820–1880, Europe, N. America. Plant hairy, 15–45 Cm. (6–18′) high, bulb at stem base, flowers May, yellow, 5's; contains volatile oil (anemonin + anemonic acid). Used as irritant, diuretic, narcotic; externally in bronchitis, rheumatism, sciatica; in decoction, infusion. Dose, ʒss–1 (2–4 Gm.).

25. BERBERIDACEÆ. Barberry Family.

Ber-be-ri-da'se-e. L. *Berber(is)id* + aceæ, fr. *Berberys—i. e.*, Arabic name of the fruit. Shrubs, herbs with watery juice. Distinguished by few stamens (same number as petals and opposite them) in 2–3 whorls, anthers opening by 2-hinged valves (Podophyllum, longitudinal, as in Ranunculaceæ); leaves usually with spiny teeth, sometimes reduced to spines or barbs, hence the name *barberry;* sepals and petals in 2 rows, 3 each, imbricate; ovary 1-celled, superior; temperate climates, tropics; cathartic, astringent, bitter, acrid (oxalic), yellow dye.

Genus: **1. Podophyllum.**

PODOPHYLLUM. PODOPHYLLUM.

Podophyllum peltatum, *Linné.* { The dried rhizome and roots, containing 3 p. c. of resin.

Habitat: N. America (Canada, United States), in rich woods, thickets.

Syn. Podoph., Mandrake, May Apple Rhizome, American (Wild) Mandrake, Ground (Wild) Lemon, Hog (Indian, Devil's) Apple, Duck's Foot, Umbrella Plant, Vegetable Mercury (Calomel); Br. Podophylli Rhizoma; Fr. Rhizome de Podophyllum; Ger. Fussblattwurzel.

Pod-o-phyl'lum. L. fr. Gr. *ποδὸς*, foot, + *φύλλον*, leaf—*i. e.*, its 5–7-parted leaf resembles the foot of aquatic birds or domestic fowls, as ducks, etc.

Pel-ta'tum. L. *peltatus*, having a pelta or light shield—*i. e.*, petioles attached to the middle of the lamina instead of to the margin.

May apple—*i. e.*, plant blooms in May, thus starting the fruit, which ripens in summer (August).

PLANT.—Perennial herb; stem .3 M. (1°) high, pale green, divides near the summit into 2 petioles, each bearing a palmately 5–7-deeply-lobed, peltate leaf 10–15 Cm. (4–6′) wide, segments wedge-shaped, coarsely toothed at their ends, glaucous-green, petioles 7.5 Cm. (3′) long; flowers May, borne at fork of petioles, single, nodding, white 5 Cm. (2′) broad, 6–9 petals, 12–18 stamens; fruit yellowish berry, 2.5–5 Cm. (1–2′) long, ovoid, fleshy, soft, indehiscent; seeds about 12; often eaten by animals, hence some of its names. RHIZOME, of horizontal growth, creeping, subcylindrical, jointed, compressed on upper and lower surfaces, sometimes branched, 3–20 Cm. ($1\frac{1}{5}$–8′) long, internodes 2–9 Mm. ($\frac{1}{12}$–$\frac{1}{3}$′) thick, nodes annulate, 12 Mm. ($\frac{1}{2}$′) thick, dark brown, longitudinally wrinkled or nearly smooth with irregular, somewhat V-shaped scars of scale leaves, upper surface of nodes marked with large, circular, depressed stem-scars, sometimes with buds or stem-bases, lower surface of nodes with numerous root-scars or roots, 2–7 Cm. ($\frac{4}{5}$–3′) long, 2 Mm. ($\frac{1}{12}$′) thick, fracture short; internally, bark light brown, wood with yellowish vascular bundles, pith large, white; odor slight; taste sweetish, disagreeably bitter, acrid. POWDER, yellowish-brown; microscopically—numerous starch grains, .003–.015 Mm. ($\frac{1}{8325}$–$\frac{1}{1650}$′) broad, few rosette aggregates of calcium oxalate, tracheæ, parenchyma, cork cells; odor pronounced, characteristic. *Solvents:* alcohol; boiling water partially. Dose, gr. 5–15 (.3–1 Gm.).

ADULTERATIONS.—Sanguinaria (due to similarity of leaves despite greater value) 2–3 p. c., geranium 2–3 p. c., comfrey 1 p. c.

Commercial.—Plants of 100 or more grow in rounded or irregular-shaped clusters (patches), 3–6 M. (10–20°) broad, near wood-borders, fence-panels, or in the open, preferably on heavy soil; rhizome and roots should be collected soon after the leaves fall off, Aug.–Sept., those containing much resin being surprisingly heavy considering their appearance, breaking with an elastic, short, noisy fracture; drug often recognized in the trade as *thick, thin, heavy, light,* referring chiefly to physical characteristics. That collected in autumn, after flowering and fruiting, is preferred, being heavier from abundant resin content (podophyllotoxin) and breaking with a cleaner fracture.

Constituents.—Resin 4–5 p. c. (varying little in quantity but greatly in content (podophyllotoxin) according to season and time of collection), starch, gum, fixed oil, gallic acid, ash 2–3 p. c.

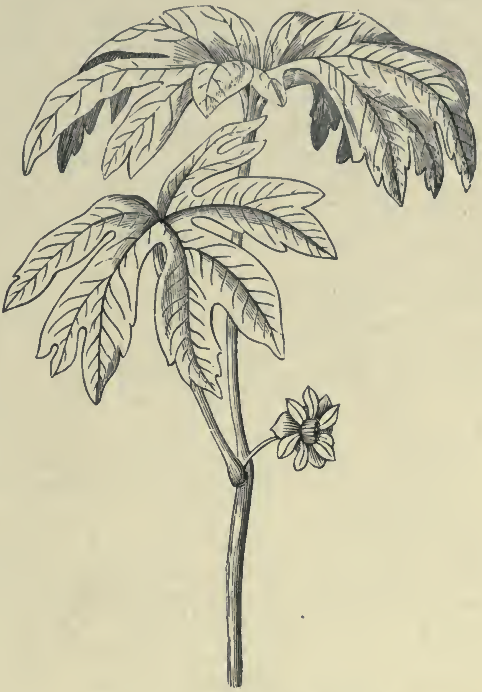


Fig. 128.—*Podophyllum peltatum.*

Resin (Resina Podophylli, Podophyllin).—This is a complex substance consisting of: (1) *podophyllotoxin*, $C_{15}H_{14}O_6$, 20–26 p. c., which

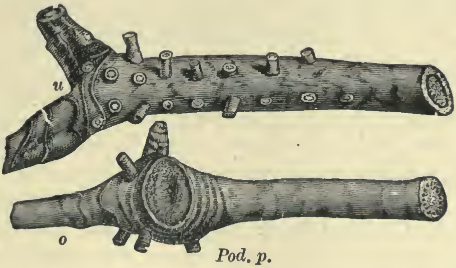


Fig. 129.—Podophyllum: *u*, under side; *o*, upper side.

is obtained after removing the fat with benzin, by precipitating the podophyllinic acid from a chloroformic solution of the resin or rhizome, by the addition of ether and then simply evaporating the ethereal solution; this is the cathartic principle, being whitish, bitter, resinous, crystallizable, soluble in chloroform, ether, acetone, alcohol; cherry-red, then greenish-blue and violet by sulphuric acid, when heated with alkalies is converted by hydration into podophyllic acid, $C_{15}H_{16}O_7$, which readily loses water, forming crystalline picropodophyllin (inactive, isomeric with podophyllotoxin); (2) *podophyllinic acid,* which is an inactive resin-acid, insoluble in ether, but soluble in chloroform or alcohol, and obtained by the above process for podophyllotoxin (being precipitated and left behind upon the addition of ether). The color is due to *podophylloquercetin,* which occurs in yellow needles, insoluble in water, slightly in chloroform, more so in ether, freely in alcohol. The small amount of uncrystallizable resin, *podophylloresin,* is also purgative.

PREPARATIONS.—1. *Fluidextractum Podophylli.* Fluidextract of Podophyllum. (Syn., Fldext. Podophyll., Fluid Extract of Podophyllum, Fluidextract of May Apple (Mandrake); Fr. Extrait fluide de Podophylle; Ger. Fussblattwurzelfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: alcohol. Dose, ♏v–30 (.3–2 Ml. (Cc.)).

2. *Resina Podophylli.* Resin of Podophyllum. (Syn., Res. Podoph., Podophyllin; Fr. Résine de Podophylle; Ger. Podophyllinum, Podophyllin, Podophyllumharz.)

Manufacture: Macerate, percolate 100 Gm. with alcohol until percolate when dropped into water only produces slight turbidity, reclaim alcohol until percolate the consistence of thin syrup, and pour this slowly, constantly stirring, into 100 Ml. (Cc.) of water mixed with hydrochloric acid 1 Ml. (Cc.), cool, let precipitate subside, decant supernatant liquid, wash precipitate twice by decantation, each time with cold water 100 Ml. (Cc.), dry on strainer in a cool place protected from light, and if it should coalesce into lumps with a glossy surface reduce to powder in a mortar. It is an amorphous powder, light brown, greenish-yellow, darker on exposure to heat or light, slight peculiar odor, faintly bitter taste; very irritating to mucous membrane, especially that of the eye; soluble in alcohol with only slight opalescence; alcoholic solution faintly acid; 75 p. c. soluble in ether; 65 p. c. soluble in chloroform. *Tests:* 1. Hot aqueous solution on cooling—deposits most of its contents; filtrate bitter, with a few drops of ferric chloride T. S.—brown. 2. Dissolve in potassium or sodium hydroxide T. S.—deep yellow liquid, becoming darker on standing, from which resin is reprecipitated by acids. 3. Add 4 Gm. to 3 Ml. (Cc.) of 60 p. c. alcohol, + .5 Ml. (Cc.) potassium hydroxide T. S., shake—does not gelatinize (dif. from resin in *P. Emodi*); ash 1.5 p. c. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$–1 (.008–.06 Gm.).

Unoff. Preps.: Abstract (alcohol), dose, gr. $\frac{1}{4}$–2 (.016–.13 Gm.). *Extract* (alcohol 80 p. c.), dose, gr. 5–10 (.3–.6 Gm.). *Pills of Podophyllum, Belladonna and Capsicum* (resin $\frac{1}{4}$ gr. (.016 Gm.)), dose, 1–3 pills.

Tincture (Br.), 3.65 p. c. of resin in alcohol, dose, ♏v–15 (.3–1 Ml. (Cc.)). *Podophyllotoxin* (pure), dose, gr. $\frac{1}{12}$–$\frac{1}{8}$ (.005–.008 Gm.).

Properties.—Hydragogue cathartic, cholagogue, alterative, irritant, tonic—slowest acting official purgative. Increases intestinal secretion, bile-flow, causes copious watery stools, griping, nausea in from 10–20 hours, acts mainly on the duodenum, but is a powerful intestinal irritant, resembling jalap and calomel, only slower; large doses are distinctly poisonous, producing in the young vomiting, purging, collapse, coma, finally epileptiform convulsions. Those employed in powdering the drug have irritation of the eyes, nose mouth, respiratory passages, and skin. The resin applied to ulcers produces purgation and is also a powerful irritant to the skin. Its action upon the liver, being somewhat similar to that of mercury, led some early to claim for it alterative properties equal to those of that metal, and for a time it was employed under the name of "vegetable calomel" in those diseases for which mercury is a recognized specific, but now it is believed to have incidentally only very slight alterative power, and to possess no property in common with mercury save that of catharsis.

Uses.—Constipation, torpid liver, lead costiveness, diarrhœa, catarrhal or malarial jaundice, remittent fevers, dyspepsia, bilious vomiting, and headache. With cream of tartar useful in dropsies, rheumatic, scrofulous, and sylphilitic affections; should be associated with hyoscyamus or belladonna to overcome griping, and, owing to extremely slow action, should not be given in combination with brisk cathartics, but preferably with such as act in approximately the same time, as calomel, jalap, aloes, leptandra, etc.—gr. 5 (.3 Gm.) of podophyllin (resin) have killed, so have ʒiss (6 Gm.), but in one case gr. 10 (.6 Gm.) failed to produce more than abdominal pains.

Allied Plants:

1. *Podophyllum Emo'di.*—India, Hazara, Kashmir; Himalaya Mountains; rhizome, collected after flowering, cylindrical, stem-scars crowded on upper surface, many roots beneath; yields resin 10–14 p. c., which contains podophyllotoxin 38–63 p. c., thereby making it similar to but stronger than our official drug. Dose of resin, gr. $\frac{1}{8}$–1 (.008–.06 Gm.).

2. *Ber'beris Aquifo'lium, Holly-leaved Barberry.*—The rhizome and roots, official 1900–1910; United States—Oregon, California, mountains. Low-trailing, glabrous shrub; leaves pinnate; leaflets 3–7, ovate, acute, dentate with spine-bearing teeth; flowers, yellow racemes; fruit blue globose berry, like whortleberry, Rhizome knotty, irregular pieces, variable length, 3–20 Mm. ($\frac{1}{8}$–$\frac{4}{5}$′) thick, small pith; bark (containing activity) $\frac{1}{2}$–2 Mm. ($\frac{1}{50}$–$\frac{1}{12}$′) thick, brownish; wood yellowish, radiate, hard, tough, inert; odor distinct; taste strongly bitter; solvent: diluted alcohol; contains (bark) berberine 2.35 p. c., oxyacanthine 2.82 p. c., resin, tannin, phytosterin. Alterative, diuretic, antiperiodic, tonic, laxative; scrofulous and syphilitic cachexia, chronic eczema, psoriasis, uterine diseases, dyspepsia with constipation. Dose, gr. 10–30 (.6–2 Gm.); fluidextract (dil. alc.), ♏x–30 (.6–2 Ml. (Cc.)).

3. *B. vulga'ris* (*canaden'sis*).—The fruit, official 1830–1840; the bark of the root, 1860–1880. Spreading shrub, 1–2 M. (3–6°) high, thorny branches, bark gray, wood yellow, leaves toothed, spiny; flowers, yellow racemes; fruit, oval, scarlet berry; root-bark yellowish-gray, separable into laminæ, bitter, astringent; contains berberine, resin, tannin, fat. Used in febrile diseases, diarrhœa; bark in dysentery, dropsy, dyspepsia, to lessen size of spleen; similar to calumba. Dose (bark), gr. 2–10 (.13–.6 Gm.); infusion, decoction; fruit juice sometimes made into syrup, preserves, etc.

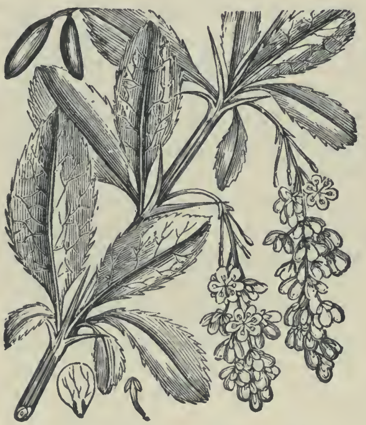


FIG. 130.—*Berberis vulgaris* (*canadensis*).

4. *Caulophyl'lum thalictroi'des, Blue Cohosh.*—The rhizome and roots, collected in spring or early summer, official 1880–1900; N. America (Canada, United States). Perennial herb, stem .6 M. (2°) high, smooth, with large triternately compound leaf at summit; leaflets 3–5-lobed; flowers greenish-yellow. Rhizome horizontal, 10 Cm. (4′) long, 8 Mm. ($\frac{1}{3}'$) thick, knotty from concave stem-scars on upper surface, grayish-brown, tough, woody; roots many, matted, 12.5 Cm. (5′) long, 1 Mm. ($\frac{1}{25}'$) thick; contains caulophylline, caulophyllin (resins) 12 p.c., leontin (saponin-like glucoside—active principle). Antispasmodic, diuretic, emmenagogue, demulcent, sternutatory, sedative, oxytocic; hysteria, amenorrhœa, spasmodic dysmenorrhœa, uterine subinvolution (causing muscular contraction), arrests or produces abortion; the aborigines believed the infusion their best parturient, drinking it for several weeks prior to labor. Dose, gr. 10–30 (.6–2 Gm.); fluidextract, ♏x–30 (.6–2 Ml. (Cc.)); extract, gr. 2–5 (.13–.3 Gm.); tincture, 25 p. c., ʒj–2 (4–8 Ml. (Cc.)); decoction, infusion, both 5 p. c., ℥j–2 (30–60 Ml. (Cc.)).

26. MENISPERMACEÆ. Moonseed Family.

Men-i-sper-ma'se-e. L. *Menisperm-um* + aceæ, fr. Gr. *μήνη*, the moon, + *σπέρμα*, a seed—*i. e.*, fruit (seed) kidney- or crescent-shaped. Shrubs, woody climbers, herbaceous vines; leaves exstipulate, alternate; flowers diœcious; sepals 4–12; petals 6, similar, usually in 2 rows, imbricate; stamens mostly 6; fruit drupe, superior; species very heteromorphous; embryo horseshoe-shape; albumin scanty; tropics; bitter, narcotic, tonic, poisonous.

Genus: **1. Jateorhiza.**

CALUMBA. CALUMBA.

Jateorhiza palmata, (*Lamarck*) *Miers.*
(Jateorhiza calumba, (*Roxburgh*) *Miers.*) } The dried root.

Habitat. E. Africa, Madagascar (Mozambique and Quilimane forests, along the lower Zambesi River); cultivated in Africa and E. India islands.

Syn. Calumb., Columba, Columbo, (Foreign) Colombo, Kalumb.; Br. Calumbæ Radix; Fr. Colombo, Racine de Colombo (Calumbé); Ger. Radix Colombo, Kolombowurzel.

Jat-e-o-rhi′za. L. fr. Gr. *ἰατήρ(ιος)*, healing, + *ῥίζα*, a root—*i. e.*, its medicinal virtues.

Pal-ma′ta. L. *palmatus*, like the palm of the open hand—*i. e.*, the leaves palmately-lobed or divided.

Ca-lum′ba. L. fr. native African name, *kalumb*, hence Colombo in Ceylon, supposed to be the plant's original habitat.

Plant.—Perennial climber; stems several, green, 6–12 Mm. ($\frac{1}{4}$–$\frac{1}{2}$′) thick, hairy, from short, thick, irregular rhizome; leaves petiolate, large, 25 Cm. (10′) long, 35 Cm. (14′) broad, orbicular, cordate, 3–5–7-palmately-lobed, lobes entire, wavy, hairy; flowers diœcious, 6's, 12 Mm. ($\frac{1}{2}$′) broad; fruit 3 ovoid fleshy drupes, size of hazelnut, 1-seeded. Roots, from rhizome, many, fleshy, fasciculated, fusiform, 2.5–10 Cm. (1–4′) thick; commercially in circular, oval disks, 2–9 Cm. ($\frac{4}{5}$–3$\frac{3}{5}$′) broad, 2–12 Mm. ($\frac{1}{12}$–$\frac{1}{2}$′) thick, or longitudinal or oblique slices, 30 Cm. (12′) long, 35 Mm. (1$\frac{2}{5}$′) broad, 16 Mm. ($\frac{2}{3}$′) thick; brown, roughly wrinkled; cut surface yellowish-gray, transverse slices radiate in outer portion with dark cambium, centre often depressed (thinnest); fracture short, mealy; odor slight; taste slightly aromatic, very bitter. Powder, yellowish-gray; microscopically—

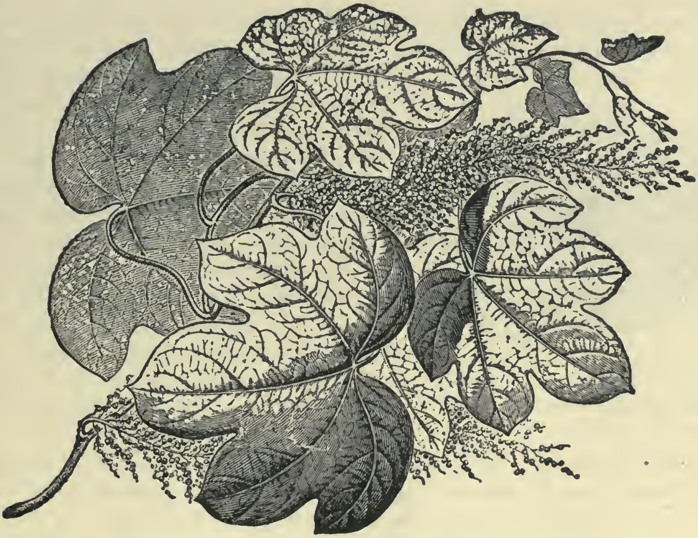


Fig. 131.—*Jateorhiza palmata* (*calumba*).

many starch grains, .003–.085 Mm. ($\frac{1}{8325}$–$\frac{1}{300}$′) broad, few stone cells with one or more calcium oxalate prisms or sphenoidal micro-crystals; few fragments with tracheæ associated with wood-fibres. *Solvents:* alcohol (75 p. c.); boiling water largely (calumbin, berberine). Dose, gr. 5–30 (.3–2 Gm.).

Adulterations.—Roots of *Bryonia alba* and *Frasera carolinensis* (*Walteri*)—American Columbo. These sometimes are dyed yellow with turmeric or safflower, and made bitter with infusion of calumba or quassia, thus giving a near resemblance, but recognized by the lighter or slightly false color, absence of dark cambium zone, radiating lines, etc.; the latter also precipitates with iron salts, is not mucilaginous nor affected by infusion of galls, reddens litmus, evolves ammonia with fixed alkalies, and contains no starch. Occasionally with slices of the stem of *Coscin'ium fenestra'tum*, Ceylon, which are harder, smoother, and not contracted centrally; false calumba—centre elevated, not depressed.

Commercial.—Plant, also named *Menispermum palmatum, Coc'culus palma'tus*, and natively called *Kalumb*, resembles very closely our *Menispermum canadense*, reaching the top of lofty forest trees from the sea-coast to many miles inland. Roots of wild plants are dug in hot dry season (March), tubercles separated, washed, cut into transverse and longitudinal slices, and dried slowly in the shade; often more or less worm-eaten. Portuguese always have controlled (1508) its trade, exporting it for 3 centuries via Colombo, Ceylon, also their possession, to veil its origin; now enters market from Zanzibar, or via Bombay.

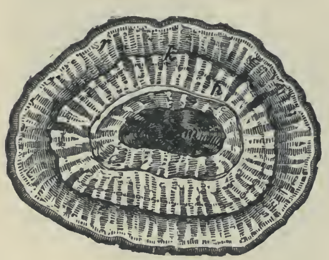


Fig. 132. — Calumba: transverse section, natural size: *r*, bark; *k*, cambium; *h*, wood; *m*, pith (medulla).

Constituents.—Calumbin .8 p. c., Berberine 1 p. c., Calumbic acid, calumbine (?), starch 35 p. c., pectin 17 p. c., gum 4.7 p. c., resin 5 p. c., wax, calcium oxalate, ash 6–8 p. c.

Calumbin, $C_{21}H_{24}O_7$.—Gives most of the bitterness—obtained by exhausting root or alcoholic extract with alcohol or ether, evaporating and letting stand several days for crystals to form, which are white, bitter, odorless, soluble in alcohol, ether, chloroform, alkalies, acetic acid, almost insoluble in water. Dose, gr. ½–1 (.03–.06 Gm.).

Berberine, $C_{20}H_{17}NO_4$.—This is left in mother-liquor from calumbin, which is evaporated to dryness, exhausted with boiling alcohol, evaporated, allowed to crystallize upon standing. Recently this content has been resolved into three alkaloids—palmatine, calumbamine, jateorhizine—which with calumbin constitute the drug's activity. Dose, gr. ½–1 (.03–.06 Gm.).

Calumbic Acid, $C_{21}H_{22}O_6 + H_2O$.—Obtained from 3 p. c. oxalic acid infusion by adding barium hydroxide and treating precipitate with alcohol; it is less bitter than calumbin, amorphous, straw-yellow, soluble in alcohol, alkalies, almost insoluble in water or ether, and is in combination with berberine—the two believed to be derived from calumbin, this latter being the anhydride of calumbic acid.

Calumba contains no tannin, hence can well be used with iron salts and alkalies as a substitute for gentian, etc.; its infusion or tincture, however, precipitates with infusion of galls or solution of lead acetate.

PREPARATIONS.—1. *Tinctura Calumbæ.* Tincture of Calumba. (Syn., Tr. Calumb., Tinctura Colombo; Fr. Teinture de Colombo; Ger. Kolombotinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 101—packing moderately; menstruum: 60 p. c. alcohol. Dose ʒss–2 (2–8 Ml. (Cc.)).

Unoff. Preps.: Extract, dose gr. 1–5 (.06–.3 Gm.). *Fluidextract* (alcohol 80, water 10, glycerin 10), dose, ♏v–30 (.3–2 Ml. (Cc.)). *Infusion,* 5 p. c., dose, ℥ss–1 (15–30 Ml. (Cc.)).

PROPERTIES.—Tonic, stomachic, stimulant, increases appetite and digestion by stimulating the gustatory nerves, thereby dilating the gastric vessels and augmenting secretion, does not constipate; externally—antiseptic, disinfectant, anthelmintic.

USES.—Dyspepsia, debility, remittent fevers, dysentery, diarrhœa, cholera morbus, cholera infantum, hectic fever of phthisis, vomiting of pregnancy, bowel flatus, purging; large doses emeto-cathartic.

Allied Plants:

1. *Jateorhiza calumba.*—About the same as the official, possibly having a variety difference in that the basal lobes of leaves are rounded but do not overlap, and male inflorescence is hispid. In the official variety, basal lobes mostly overlap, and male inflorescence is smooth. Our commercial root is collected indiscriminately from both species.

2. *Anamir'ta Coc'culus (panicula'ta), Cocculus Indicus.*—E. India, Ceylon. Large woody climber; leaves 10–20 Cm. (4–8′) long, cordate; flowers, small diœcious; fruit (in clusters 2–5) reniform, drupe, 8 Mm. ($\frac{1}{3}$′) long, blackish-brown, wrinkled; seed reniform; contains (seed)—picrotoxin, anamirtin (cocculin, not bitter or poisonous), fat; (pericarp, nearly tasteless)—menispermine, paramenispermine, hypopicrotoxic acid, resin. *Picrotoxin* (picrotoxinum), $C_{30}H_{34}O_{13}$—official 1880–1900, not a single body, but composed of picrotoxin 54 p. c., and picrotin 46 p. c.; obtained by evaporating to syrup a tincture made with hot alcohol, removing fat, boiling residue with water, filtering, which deposits picrotoxin upon cooling. It is in colorless, shining prismatic crystals or powder, odorless, very bitter, soluble in alcohol, ether, chloroform; with $H_2SO_4 + NaNO_3 + NaOH$ gives brick-red, fading in few hours. Cerebro-spinal excitant, nervine, antiparasitic, with combined action of belladonna and nux vomica; slows heart and respiration, causes spasms of flexors, death by paralyzing heart; convulsions resemble epileptic paroxysms (circular spasms)—those of strychnine being tonic (tetanic), affecting the extensors; paralysis (laryngeal), epilepsy, chorea, eclampsia, chronic spasms of the limbs,

vomiting with giddiness, morphine antidote; externally—parasitic skin diseases, itch, lice, ringworm (avoiding abraded surfaces); powdered berries, mixed with dough, sometimes thrown upon water in order to catch fish; after eating this, fish whirl around, become stupefied, and lie motionless upon the surface, so that they may readily be picked up; berries also prevent secondary fermentation of alcoholic liquors, adding

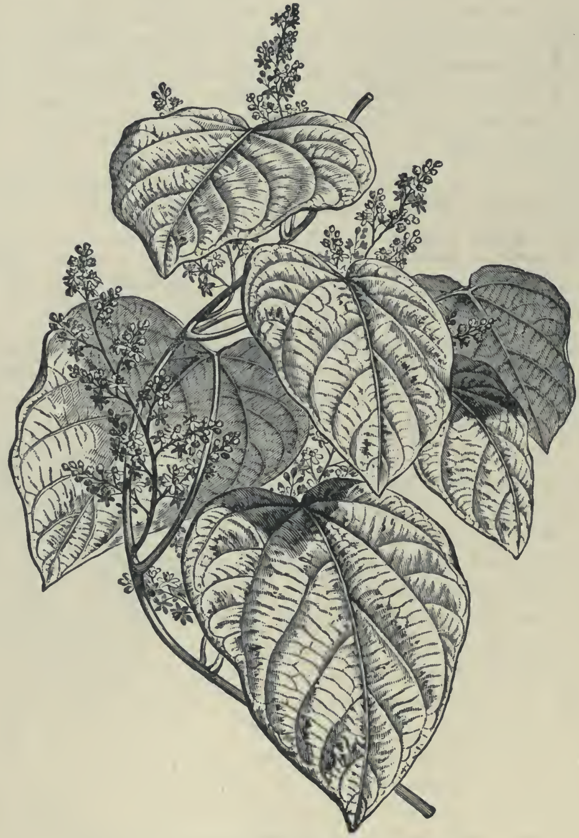


FIG. 133.—*Anamirta Cocculus* (*paniculata*).

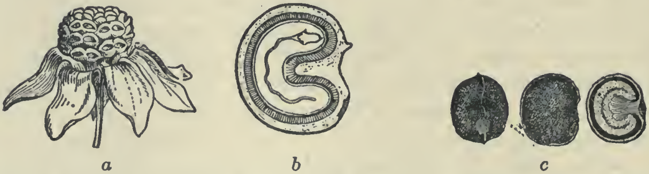


FIG. 134.—*Anamirta Cocculus: a*, staminate flower; *b*, longitudinal section of fruit, magnified; *c*, fruit and section, normal size.

strength thereto, but dangerous. *Poisoning:* Symptoms and treatment similar to strychnine. Dose, seeds, gr. 1–3 (.06–.2 Gm.); tincture 10 p. c. (diluted alcohol), ♏ij–15 (.13–1 Ml. (Cc.)); picrotoxin, gr. $\frac{1}{64}$–$\frac{1}{32}$ (.001–.002 Gm.); menispermine, gr. 1–2 (.06–.13 Gm.); decoction, 2. 5. p. c.; ointment, 2 p. c.

3. *Chondroden'dron tomento'sum, Parei'ra, Parei'ra Bra'va.*—The dried root, official 1840–1910; Brazil, near Rio Janeiro, Peru. Tall woody climber; stem 1–10 Cm. ($\frac{2}{5}$–4′) thick; bark rough, with elevated prominences; leaves 12.5–30 Cm. (5–12′) long, ovate, cordate, petiolate, smooth above, finely woolly beneath; flowers diœcious, panicles; fruit purplish-black drupe, 6 in a bunch like grapes. Root subcylindrical, tortuous, in pieces 10–15 Cm. (4–6′) long, 1–6 Cm. ($\frac{2}{5}$–2′) thick, brownish, furrowed, hard, heavy, tough; internally brownish-gray, waxy lustre (fresh), 2 or more inequilaterally concentric circles of porous wood-wedges (12) retracted from intervening medullary rays; odor slight; taste bitter; bluish-black with iodine T. S.; solvents: alcohol (70 p. c.), boiling water; contains pelosine (cissampeline—identical with beberine, buxine, paricine), tannin, starch, gum, ash 6–11 p. c. Diuretic, tonic, laxative; cystitis, calculi, gonorrhœa,

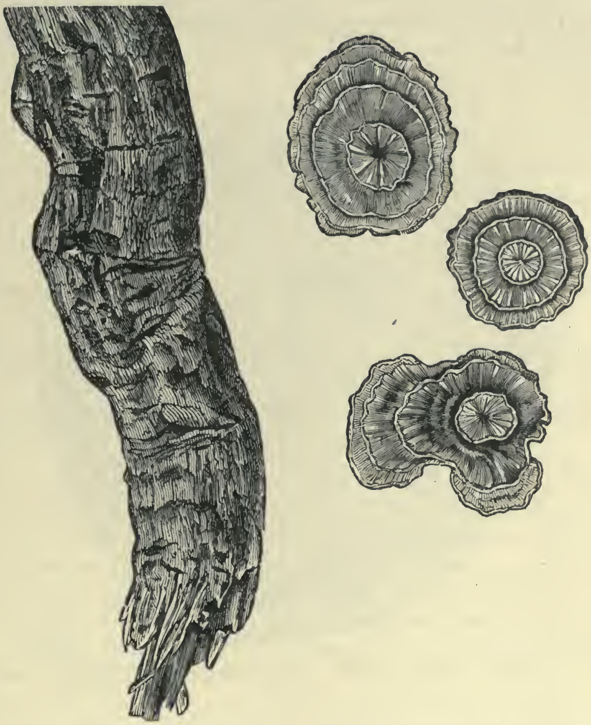


FIG. 135.—Pareira (brava): portion of a root and transverse section of the same.

leucorrhœa, dropsy, rheumatism, jaundice; natively for bites of poisonous serpents (leaves to wound, vinous infusion internally). Dose, ʒss–1 (2–4 Gm.); extract, gr. 10–20 (.6–1.3 Gm.); fluidextract (dil. alc.), ʒss–1 (2–4 Ml. (Cc.)); infusion and decoction, 5 p. c., ℥j–2 (30–60 Ml. (Cc.)).

4. *Cissam'pelos parei'ra* (Gr. κισσός, ivy, + ἄμπελος, a vine).—W. Indies, C. America. Root and stem 6–25 Mm. (¼–1′) thick, not concentric, wood in 20 porous wedges, separated by narrow medullary rays, bark brownish-gray, suberous; lighter than the official, non-waxy, and the infusion gives no blue color with tincture of iodine.

5. *Menisper'mum canaden'se, Yellow Parilla, Canadian Moonseed.*—The rhizome and roots, official 1880–1900; N. America (Canada to S. Carolina). Perennial climber, 2.5–3.5 M. (8–12°) long; stem round, striate; leaves 10–12.5 Cm. (4–5′) broad, peltate, 3–5-lobed, pale beneath, petioles long; flowers small, yellowish; fruit 8 Mm. (⅓′) thick, black, resembling grapes. Rhizome 1 M. (3°) long, 6 Mm. (¼′) thick, yellowish-brown, knotty, wrinkled lengthwise, roots many, fracture tough, woody, inside yellowish, bark thick, wood-rays broad, porous, and longest on lower side, pith distinct; nearly inodorous; taste bitter; contains berberine (yellow), menispine, starch, gum, resin, tannin. Tonic, alterative, diuretic; similar to calumba (owing to its bitterness); scrofulous affections, as a substitute for sarsaparilla. Dose, gr. 15–60 (1–4 Gm.); fluidextract (alcohol 65 p. c.), ʒss–1 (2–4 Ml. (Cc.)).

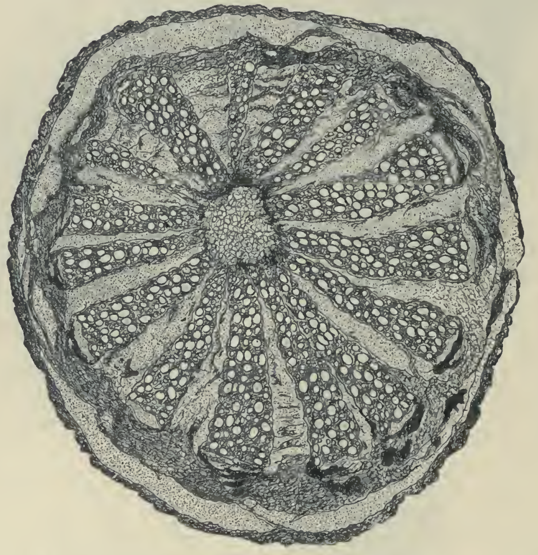


FIG. 136.—*Menispermum canadense:* transverse section of rhizome magnified.

27. LAURACEÆ. Laurel Family.

La-ra′se-e. L. *Laur-us* + aceæ, bay tree, fr. Celtic *blaur* (*laur*, the *b* dropped), signifying green—*i. e.*, referring to plant's foliage. Trees, shrubs. Distinguished by being aromatic (volatile oils); leaves simple, pellucid-dotted; flowers polygamous, calyx 4–6, in 2 rows, petaloid, regular; stamens perigynous, distinct, anthers opening by 2–4 uplifted valves; ovary 1-celled; ovules 1 in each cell; fruit drupe or berry; tropics, temperate climates; aromatic, stimulant (vol. oil), narcotic, sudorific, tonic, stomachic, febrifuge, astringent; timber, some fruit edible.

Genera: **1. Sassafras. 2. Cinnamomum.**

SASSAFRAS. SASSAFRAS.

Sassafras variifolium, *(Salisbury) O. Kuntze.* — The bark of the root, with not more than 2 p. c. of adhering wood, collected in early spring or autumn, deprived of outer corky layer and dried.

Habitat. N. America—Canada, Florida to Texas; sandy, light soil, in the open.

Syn. Sassaf., Saxifrax, Saloop, Ague Tree, Cinnamon Wood; Sassafras (Cortex) Radix; Fr. Écorce de Sassafras; Ger. Lignum Sassafras, Sassafrasholz, Sassafrasrinde.

Sas′sa-fras. L. *saxum*, rock, + *frangere*, to break—*i. e.*, grows in crevices of rocks; Sp. for *saxifrage*, name given by Monardes, Spanish botanist of 16th century.

Va-ri-i-fo′li-um. L. *varius*, varying, + *folium*, leaf—*i. e.*, leaves of several forms on the same tree, ovate, entire, 3-lobed and cuneate at base.

Plant.—Shrub in the North, tree in the South, 9–24 M. (30–80°) high, .3–.6 M. (1–2°) thick; wood whitish, reddish, light, strong, durable, aromatic; bark of stem and large branches rough, deeply furrowed, grayish, divisible into layers, young end-twigs smooth, green; leaves 10–15 Cm. (4–6′) long, varying shape; flowers, March–May, diœcious, fragrant, appearing before leaves, small, greenish-yellow, racemes; fruit oval drupe, size of a pea, deep blue, 1-seeded. Bark, in irregularly, transversely curved, quilled pieces, 1–15 Cm. ($\frac{2}{5}$–6′) long, 1–4 Mm. ($\frac{1}{25}$–$\frac{1}{6}$′) thick, orange-brown, nearly smooth and marked with irregular ridges; inner surface reddish-brown, obscurely short-striate; fracture short with thin reddish-brown corky layer and yellowish-white inner bark; odor aromatic; taste slightly mucilaginous, astringent, aromatic, somewhat pungent. Powder, light reddish-brown; microscopically—numerous starch grains, .003–.02 Mm. ($\frac{1}{8325}$–$\frac{1}{1250}$′) broad, prominent, characteristic, fusiform bast-fibres, parenchyma cells containing starch grains or yellowish-red masses of tannin, few fragments of wood with thin-walled tracheæ. *Solvents:* alcohol; hot water. Dose, ʒss–1 (2–4 Gm.).

Adulterations.—Bark: Rare—chiefly stem bark; Oil: Camphor oil, distilled in fractions and having the same specific gravity; often sold as artificial oil of sassafras, difficult to distinguish.

Commercial.—Bark of stem occurs in elongated strips or fragments, lighter gray, longer and deeper fissures on outer surface, less aromatic, more mucilaginous and bitter; powder of stem-bark without starch grains, with thick-walled wood-fibres; oil is obtained preferably from root-bark, owing to the larger yield, but in practice the whole root frequently is chipped up and distilled, yielding about .2 p. c. of unrectified oil; Maryland is the centre of production.

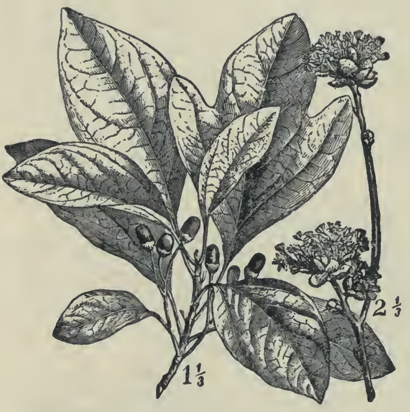


FIG. 137.—*Sassafras variifolium: 1*, fruiting twig; *2*, flowering twig.

CONSTITUENTS.—Volatile oil 6–9 p. c., Sassafrid 9 p. c., tannin 6 p. c., resin, starch, gum, wax, ash 30 p. c.

Oleum Sassafras. Oil of Sassafras, *official.*—(Syn., Ol. Sassaf., Sassafras Oil; Fr. Essence de Sassafras; Ger. Sassafrasöl.) This volatile oil distilled from the root (better—root-bark) with water or steam, is a yellow, reddish-yellow liquid, characteristic odor and taste of sassafras, soluble in 2 vols. of 90 p. c. alcohol, solution being neutral, sp. gr. 1.070, dextrorotatory; contains chiefly safrol, $C_{10}H_{10}O_2$, 80 p. c., pinene and phellandrene, $C_{10}H_{16}$, 10 p. c., *d*-camphor 6.8 p. c., eugenol, $C_{10}H_{12}O_2$, .5 p. c., cadinene, residue 3 p. c. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

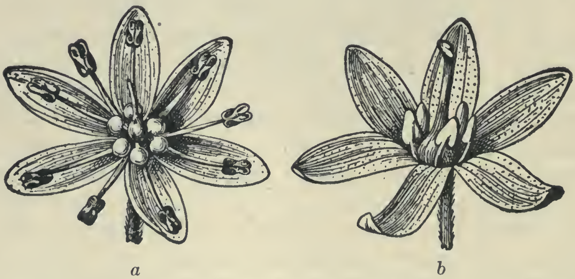


FIG. 138.—*Sassafras variifolium: a*, staminate flower; *b*, pistillate flower.

Sassafrid.—Supposed to be altered tannin, the result of oxidation, analogous to cinchona-red; some disclaim its presence in fresh bark; crystallizes in yellowish-brown granules, soluble in alcohol, insoluble in ether, solutions colored red by alkalies, precipitated by alkaline earths (carmine-red), ferric salts (greenish-brown), lead acetate (white), inodorous, nearly tasteless.

PREPARATIONS.—BARK: 1. *Fluidextractum Sarsaparillæ Compositum*, 10 p. c. OIL: 1. *Syrupus Sarsaparillæ Compositus*, $\frac{1}{50}$ p. c. 2. *Trochisci Cubebæ*, ♏$\frac{1}{6}$ (.01 Ml. (Cc.)).

Unoff. Preps.: BARK: *Fluidextract*, dose, ʒss–1 (2–4 Ml. (Cc.). *Infusion* (*Tea*), dose, *ad libitum*. PITH: *Mucilage*, 2 p.c., dose, *ad libitum*.

PROPERTIES.—Alterative, diaphoretic, stimulant, emmenagogue.

USES.—To purify blood, skin diseases, rheumatism, syphilis. Infusion valuable antidote for poison-ivy, internally and externally; it (tea) was popular at one time for so-called thinning the blood (alterative) in spring; given with sarsaparilla, guaiacum, mezereum, etc.; oil popular flavoring agent in confectionery, drinks, soaps, etc., anti-emetic, antagonist to narcotic effects of tobacco, hyoscyamus, etc.

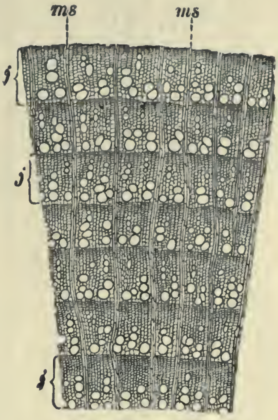


FIG. 139. — Sassafras wood: cross-section, magnified 20 diam.; *j*, annual rings; *ms*, medullary rays.

Derivative Products:

1. *Safrolum*, *Safrol*, $C_{10}H_{10}O_2$ — $C_6H_3.C_3H_8.(OOCH_2)$. This chemically is the methylene ether of allyl pyrocatechol, occurring in the oils of camphor, star-anise, cinnamon, etc., and constitutes 80 p. c. of the oil of sassafras. It is obtained chiefly from the red oil of camphor by collecting that fraction boiling at 230° C. (446° F.), purifying the same by repeated chilling and crystallization; it is a colorless or faintly yellow liquid, sassafras-like odor, sp. gr. 1.105, optically inactive, cooled to −20° C. (−4° F.) solidifies to a mass of crystals, melting at 11° C. (52° F.), soluble in alcohol (1), 70 p. c. alcohol (30), miscible with ether, chloroform, boils at 233° C. (451° F.); heated with alcoholic potassium hydroxide solution forms isosafrol, which is less toxic than safrol; with bromine yields crystals of $C_{10}H_5Br_5O_2$. Reduces arterial pressure by depressing vasomotor centre; taken a long period produces fatty degeneration of heart, liver, and kidneys; it is eliminated as piperonalic acid. Dose, ♏j–2 (.06–.13 Ml. (Cc.)).

2. *Sassafras Medula*, official 1830–1910; dose, ʒj–4 (4–15 Gm.); demulcent; mucilage 2 p. c.

3. *Sassafras Lignum, Sassafras Wood.*—Contains little volatile oil; used like the bark, but very weak medicinally.

Allied Plants:

1. *Umbellula'ria califor'nica, California Bay Laurel* or *Spice Tree.*—Wood brownish, close-grained, esteemed for cabinet-work; leaves yield volatile oil 4 p. c., with nutmeg and cardamom odor; seeds contain a fat; stimulant, anodyne in diarrhœa, neuralgia, headache.

2. *Bol'du Bol'dus, Boldo Leaves.*—Oval, 3–7 Cm. ($1\frac{1}{5}$–3′) long, 1–4 Cm. ($\frac{2}{5}$–$1\frac{3}{5}$′) broad, entire, coriaceous, petiolate, odor peculiar, bitter, pungent; contains vol. oil, resin, boldine, tannin. Sedative, hypnotic, tonic; dyspepsia, hepatitis, rheumatism. Dose, gr. 5–10 (.3–.6 Gm.); fluidextract (alcohol).

RECAPITULATION No. 2.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Dose.
Zingiberaceæ: 1. Zingiber. 2. Ginger.	Zingiber officinale.	The dried rhizome.	India, Africa, Hindustan.	Volatile oil, gingerol, resin, starch, mucilage.	Fluidextr., syrup, oleoresin, tinct., pulv. arom., pulv. rhei comp.	Carminative, stimulant, sternutatory, rubefacient, sialagogue.	Dyspepsia, diarrhœa, cholera, bronchitis, rheumatism, toothache, headache, colic.	Grains. 5–20 (.3–1.3 Gm.).
Orchidaceæ: 1. Vanillinum. 2. Vanillin.	Vanilla planifolia.	Methylprotocatechuic aldehyde.	E. Mexico.	$C_8H_8O_3$.	....	Carminative, stimulant, aphrodisiac, irritant.	Hysteria, flavoring agent.	$\frac{1}{6}$–$\frac{1}{2}$ (.01–.03 Gm.).
Piperaceæ: 1. Cubeba. 2. Cubeb.	Piper Cubeba.	The dried unripe fruit.	Java, Sumatra, Borneo, W. Indies.	Volatile oil, resin, cubebin, cubebic acid, fixed oil.	Oleoresin, troches, oil.	Diuretic, stimulant, carminative, irritant.	Gonorrhœa, cystitis, bronchitis, catarrh, vesical irritability.	15–60 (1–4 Gm.).
1. Piper. 2. Pepper.	Piper nigrum.	The dried unripe fruit.	S. India, Malabar.	Piperin, volatile oil, piperidine, chavicin, fixed oil.	Oleoresin.	Stimulant, tonic, febrifuge, irritant, antipyretic.	Intermittents, rheumatism, colic, headache, indigestion, gleet.	5–20 (.3–1.3 Gm.).
Salicaceæ: 1. Salicinum. 2. Salicin.	Salix and Populus species.	A glucoside.	Europe, N. America.	$C_{13}H_{18}O_7$.	....	Bitter, tonic, antiperiodic, antipyretic, antiseptic, antiferment.	Rheumatism, intermittents, coryza, neuralgia, diabetes, eczema, cancer, relieves pain.	10–30 (.6–2 Gm.).
Fagaceæ (Cupuliferæ): 1. Galla. 2. Nutgall.	Quercus infectoria.	The excrescence.	Mediterranean Basin.	Tannin, gallic acid, mucilage, starch.	Oint., *Tannin:* glycerite, troch., oint., gallic acid, pyrogallic acid.	Astringent, tonic.	Diarrhœa, gleet, relaxed membranes, sore mouth, antidote to alkaloidal poisoning.	5–30 (.3–2 Gm.).
Ulmaceæ: 1. Ulmus. 2. Elm.	Ulmus fulva.	The dried inner bark.	N. America.	Mucilage, starch, tannin, bitter principle.	....	Demulcent, emollient, nutritive.	Diarrhœa, urinary affections, bronchitis, boils, fissures, strictures.	120–240 (8–15 Gm.).
Moraceæ: 1. Humulus. 2. Hops.	Humulus Lupulus.	The dried strobiles.	N. Temperate zone.	Vol. oil, choline, resin, tannin, salts.	....	Tonic, sedative, anodyne, hypnotic.	Dyspepsia, delirium, priapism, bladder troubles, rheumatism, boils, colic, bruises.	30–60 (2–4 Gm.).
1. Cannabis. 2. Cannabis.	Cannabis sativa, or var. indica.	The dried pistillate flowering tops.	Asia, N. India, United States.	Cannabinol, Cannabin, choline, vol. oil.	Extract, fluidextr., tincture.	Anodyne, nervine, sudorific, narcotic, aphrodisiac.	Neuralgia, gout, tetanus, chorea, hysteria, epilepsy, delirium tremens.	1–5 (.06–.3 Gm.).
Santalaceæ: 1. Oleum Santali. 2. Oil of Santal.	Santalum album.	The volatile oil.	S. India, E. Indian Islands.	Santalol—$C_{15}H_{26}O$.	....	Astringent, stimulant, diuretic.	Bronchitis, gonorrhœa, cystitis, pyelitis, diarrhœa.	Minims. 5–20 (.3-1.3 Ml. (Cc.)).

Aristolochiaceæ: 1. Serpentaria. 2. Serpentaria.	Aristolochia: Serpentaria, reticulata.	The dried rhizome and roots.	United States.	Volatile oil, aristolochine, resin, tannin, starch.	Tinct. cinch. co.	Stimulant, tonic, diaphoretic, antiperiodic.	Pneumonia, intermittents, dyspepsia, diphtheria.	Grains. 5–30 (.3–2 Gm.).
Polygonaceæ: 1. Rheum. 2. Rhubarb.	Rheum: officinale, palmatum, var. tanguticum.	The dried rhizome and roots.	W. and C. China.	Resin, cathartic acid, vol. oil, chrysophanic acid, emodin, aloe-emodin, rheinolic acid, rhein, starch, rheotannic acid, Ca oxalate.	Extr., fluidextr., syrup, pillscomp., pulv. comp., tinct., ar. tr., ar. syr.	Aperient, purgative, astringent, stomachic, tonic.	Diarrhœa, hemorrhoids, chronic dysentery, thread-worms, bilious fever.	5–30 (.3–2 Gm.).
Chenopodiaceæ: 1. Oleum Chenopodii. 2. Oil of Chenopodium.	Chenopodium ambrosioides, var. anthelminticum.	The volatile oil.	W. Indies, C. and S. America.	Pinene, + $C_{10}H_{16}O$.	....	Anthelmintic, vermifuge, round-worms.	Worms, intermittents, hysteria, chorea, nervousness, tænia.	Minims. 2–10 (.13–.6 Ml. (Cc.)).
Myristicaceæ: 1. Myristica. 2. Myristica.	Myristica fragrans.	The kernel of the seed.	Moluccus (Spice Islands), India.	Volatile oil, fixed oil, starch, proteids.	Ar. pulv., tr. lav. co., tr. rhei ar., troch. sod. bicarb. *Oil:* Sp. aur. ar.	Stimulant, stomachic, condiment, flavoring, narcotic.	Flatulence, diarrhœa, nausea, colic, dyspepsia, carminative.	Grains. 5–20 (.3–1.3 Gm.).
Ranunculaceæ: 1. Hydrastis. 2. Hydrastis.	Hydrastis canadensis.	The dried rhizome and roots.	N. America.	Hydrastine, berberine, canadine, resin.	Extr., fluidextr., glycerite, tincture, hydrastinine hydrochloride.	Alterative, tonic, aperient, antiperiodic, nervine.	Dyspepsia, costiveness, malaria, jaundice, catarrh, gonorrhœa.	5–30 (.3–2 Gm.).
1. Cimicifuga. 2. Cimicifuga.	Cimicifuga racemosa.	The dried rhizome and roots.	United States, Canada.	Cimicifugin, resin, vol. oil, fat, tannin.	Extract, fluidextr.	Alterative, emmenagogue, sedative.	Bronchitis, rheumatism, amenorrhœa, chorea, dyspepsia.	5–30 (.3–2 Gm.).
1. Staphisagria. 2. Staphisagria.	Delphinium Staphisagria.	The ripe seeds.	Mediterranean Basin.	Delphinine, delphinoidine, delphisine, staphisagrine, fixed oil.	Fluidextract.	Diuretic, cathartic, rubefacient, poisonous.	Parasiticide, rheumatism, neuralgia, itch, vermin.	1–2 (.06–.13 Gm.).
1. Aconitum. 2. Aconite.	Aconitum Napellus.	The dried tuberous root.	Europe, Asia, N. America.	Aconitine, aconine, picraconitine, pseudaconitine, resin, aconitic acid.	Extract, fluidextract, tincture.	Sedative, anodyne, antipyretic, poison.	Fevers, rheumatism, neuralgia, gout, pneumonia.	1–2 (.06–.13 Gm.).
Berberidaceæ: 1. Podophyllum. 2. Podophyllum.	Podophyllum peltatum.	The dried rhizome and roots.	N. America.	Resin (podophyllin—podophyllotoxin), starch, fixed oil.	Fluidextract, resin.	Cathartic, tonic, alterative.	Constipation, torpid liver, diarrhœa, fevers, jaundice.	5–15 (.3–1 Gm.).
Menispermaceæ: 1. Calumba. 2. Calumba.	Jateorhiza palmata (calumba).	The dried root.	E. Africa.	Calumbin, berberine, calumbic acid, resin, starch.	Tincture.	Tonic, stomachic, stimulant.	Dyspepsia, debility, remittent fevers, diarrhœa, phthisis.	5–30 (.3–2 Gm.).
Lauraceæ: 1. Sassafras. 2. Sassafras.	Sassafras variifolium (Sassafras).	The bark of the root.	N. America.	Volatile oil (safrol), sassafrid, resin, tannin, starch.	Fluidextr. sars. co. *Oil:* syr. sars. co., troch. cub.	Alterative, diaphoretic, stimulant.	Skin diseases, rheumatism, syphilis.	30–60 (2–4 Gm.).

CINNAMOMUM. CINNAMON.

1. Cinnamomum Saigonicum. Saigon Cinnamon.
2. Cinnamomum Zeylanicum. Ceylon Cinnamon.

Cinnamomum { 1. species undetermined,
2. **zeylanicum,** *Breyne.* }
1. The dried bark. 2. The dried bark of cultivated trees, with not more than 3 p. c. of the outer bark, foreign matter.

Habitat. 1. Annam (Cochin China). 2. Ceylon; cultivated in China, Java, Sumatra, South America, W. Indies.

Syn. 1. Cinnam. Saigon., Annam—China—God's Cinnamon, Annam Cassia, Cortex Cinnamomi Saigonici; Fr. Cannelle de Saigon; Ger. Saigonzimt. 2. Cinnam. Zeylan., Cinnamomum (U. S. P. 1880); Br. Cinnamomi Cortex, True Ceylon Cinnamon, True or Suet Cinnamon, Cinnamomum (acutum) verum; Fr. Cannelle de Ceylon; Ger. Ceylonzimt, Brauner Canel.

Cin-na-mo'mum. L. fr. Ar. *kinnamon*, cinnamon, probably connected with *qaneh*, a reed, cane—*i. e.*, resemblance of stems; or Malay *kaju manis*, sweet wood, from its aromatic odor and taste.

Sa-i-gon'i-cum. L. belonging to Saigon, a country and city in Southern Annam—*i. e.*, its native habitat.

Ze-y-lan'i-cum. L. belonging to Ceylon—*i. e.*, its habitat.

Plants.—Handsome evergreen trees, 6–9 M. (20–30°) high, trunk .3–.5 M. (12–18′) thick, young twigs slightly quadrangular; leaves coriaceous, 3–5-nerved, but only midrib reaches apex, bright glossy-green above, glaucous beneath, 10–20 Cm. (4–8′) long; flowers Jan.–March, small, hermaphrodite or polygamous, fleshy, black, ovoid, size of small olive, adhering, like acorn, to cup-shaped perianth. Bark (*C. Laureirii*, + —?): *Saigon*, in quills, 30 Cm. (12′) long, 3–30 Mm. ($\frac{1}{8}$–$1\frac{1}{5}$′) broad; bark .5–3 Mm. ($\frac{1}{50}$–$\frac{1}{8}$′) thick, light brown, dark purplish-brown with grayish patches of foliaceous lichens and numerous bud-scars, finely wrinkled, especially that of younger twigs, otherwise rough from corky patches surrounding the lenticels; inner surface reddish-brown, granular, slightly striate; fracture short—inner bark porous from large oil and mucilage cells, and separated from the outer by a layer of stone cells; odor aromatic; taste sweetish, aromatic, pungent; (*C. zeylanicum*): *Ceylon*, in closely rolled double quills of 7–12 thin layers of separate pieces of bark, 30–50 Cm. (12–20′) long, 8–13 Mm. ($\frac{1}{3}$–$\frac{1}{2}$′) broad, bark 1 Mm. ($\frac{1}{25}$′) thick, pale yellowish-brown, smooth, longitudinally striate with narrow groups of bast-fibres and brownish patches, occasional perforations marking the nodes; inner surface light brown, with faint longitudinal striations; fracture short with projecting bast-fibres; odor agreeably aromatic; taste

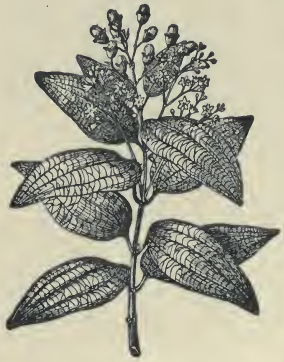


Fig. 140. — Cinnamomum twig, showing leaf venation.

sweetish, warmly aromatic; when distilled yields .5–1 p. c. of volatile oil (less than preceding—.5–1.5 p. c.), the most delicate of all, and only approximated by the finer grades of other varieties. POWDER, yellowish-brown; microscopically—numerous starch grains, .003–.02 Mm. ($\frac{1}{8325}$–$\frac{1}{1250}$′) broad, colorless stone cells, numerous cellular reddish-brown fragments, calcium oxalate raphides; Saigon has many cork cells, Ceylon few or none, while bast-fibres of former are in groups of 2–20, of latter single and fusiform; volatile extractive soluble in ether .5 (Ceylon) –2 p. c. (Saigon). *Solvents:* alcohol; hot water partially. Dose, gr. 5–30 (.3–2 Gm.).

ADULTERATIONS.—BARK: 1, Cassia bark, and a closely resembling bark of unknown derivation, having lighter gray color and coarser structure identified by weak odor and taste; possibly unscraped Guava bark quills, and clove bark; 2, Scarcely possible in the entire state; POWDER: That of either variety not found on the market, all so labeled being cassia, which is subject to endless admixtures—chips, siftings, buds, walnut-shells, oil stone, flour, sand, beans, grains, starch, clove-buds—exhausted drug, by percolation, distillation; ash (sometimes) 8–10 p. c.; OIL: That distilled from flowers and roots, phenol, oil of clove, petroleum, colophony, lead.

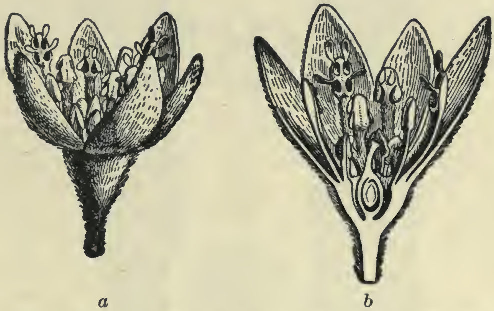


FIG. 141.—Cinnamomum: *a*, flower; *b*, vertical section of the same.

Commercial.—Cinnamon was a very early favorite spice, being brought by Arabian navigators to the Phœnicians, Grecians, and Romans, the Chinese cassia being used first, the Ceylon not until 1275. While there are about 50 species growing wild, only a few yield the commercial bark—this resulting mostly from cultivated plants. At one time Ceylon excelled in the industry, but there coffee largely has replaced it, thus restricting to the neighborhood of Colombo the principal cinnamon gardens; however, S. China has become equally interested in the cultivation and as a result produces much valuable bark. There are two important varieties: 1, *Saigon, Annam Cassia* (*Cinnamon*), thought to be entirely from wild trees (*C. Lourei'rii*, after Loureio, celebrated botanist, and other species), growing in the mountainous districts of Annam. While chips and thick trunk-bark sometimes reach us, most is from branches and small stems, all being of good quality—sweet, aromatic, almost void of astringency and bitterness; some consider it high-grade cassia, but its own specific structure, area of growth, and absence of objectionable qualities in the corky layer seem to preclude such a possibility; certainly it is related more closely to cassia than to Ceylon, and may be an inferior grade (from one or more species distinct from *C. Cassia*) of that distinctive Chinese cinnamon so highly prized by the natives; 2, *Ceylon* (*Cinnamon*), considered best, being nearly all from cultivated plants through the process of pollarding, so that in 2–3 years many slender stems are produced with bark devoid of astringent and corky layer, this latter not yet having had time to form. The cultivation of cinnamon begins with the planting of seeds in prepared soil, 4–5 in each hill, from which, in 5–6 years, the straight stems due to continued pruning, 1.5–3 M. (5–10°) high, are cut down with catty-knives, and by coppicing a new crop of twigs is formed every 2–3 years. The barking (March–June, after which delicacy and aroma lessen) takes place under cover by making 2 equidistant longitudinal incisions and transverse ones every few feet apart, then teasing off easily with a mama-knife (Saigon); the bark may now be allowed to wilt or undergo partial fermentation for several days, becoming soft and pliable, thus facilitating epidermal separation, when it is laid concave downward and scraped to the layer

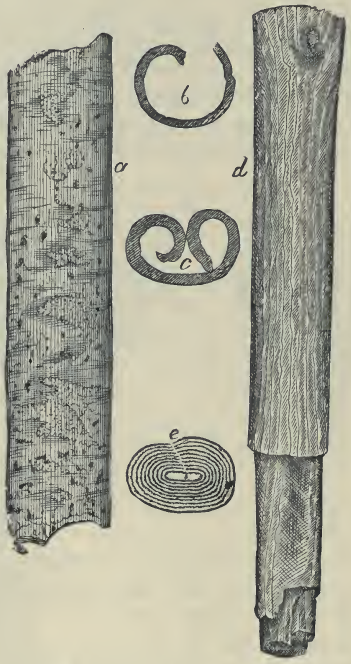


Fig. 142.—Cinnamomum: *a*, *b*, *c*, from China; *d*, *e*, from Ceylon.

of stone cells, thereby rejecting the bitter or astringent portion (Ceylon); congeries of quills are formed, which when dried (first by shade, then by sun) are made into 30-pound (14 Kg.) bundles and marketed as to quality in *firsts, seconds, thirds*, the inferior grades being distilled for oil; or each quill is dried separately (Saigon) and tied into bundles for exportation. The bark is imported loose or in bundles with split bamboo bands from Canton, Hong Kong (Saigon), Calcutta, Colombo.

CONSTITUENTS.—Volatile oil .5–2 p. c., tannin 3–5 p. c., resin, bitter principle, sugar, mannite, starch, mucilage, ash 6 p. c., of which 2 p. c. is insoluble in diluted hydrochloric acid.

Oleum Cassiæ. Oil of Cinnamon, *official.*—(Syn., Ol. Cass., Oleum Cinnamomi, U. S. P. 1900, Cassia Oil, Oleum Cinnamomi Cassiæ, Oil of Chinese Cinnamon; Fr. Essence (Huile) de Cannelle de Chine; Ger. Zimtöl, Zimtkassienöl.) This volatile oil distilled from the leaves and waste bark of *Cinnamomum Cassia* (Chinese), and rectified by steam distillation, is a yellowish, brownish liquid, darker and thicker by age and exposure, characteristic odor and taste of cinnamon, sp. gr. 1.055 soluble in 2 vols. of 70 p. c. alcohol, optically almost inactive; contains at least 80 p. c. of cinnamic aldehyde, C_8H_7CHO (oxidizing into resin and cinnamic acid) upon which the value depends, also cinnamyl acetate, $C_9H_9C_2H_3O_2$ (liquid of unpleasant acrid taste), and phenylpropyl acetate, orthocumaric aldehyde, cinnamic acid, $C_9H_8O_2$; this latter is not in fresh oil, and after being formed becomes, by further oxidation, benzoic acid. *Tests:* 1. Shake oil (2) with purified petroleum benzin (5–10)—decanted liquid is colorless and gives no green color when shaken with equal volume of (1 in 1000) copper acetate solution (abs. of rosin). Should be kept cool, dark, in well-stoppered, amber-colored bottles. The Ger. P. and U. S. P. recognize only the oil of Chinese cinnamon (cassia), while the Br. P. and Fr. Codex that of Ceylon cinnamon; the former is more abundant and cheaper, the latter of finer flavor and more delicate aroma, containing besides cinnamic aldehyde, some eugenol and phellandrene. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

PREPARATIONS.—I. SAIGON BARK: 1. *Tinctura Cinnamomi.* Tincture of Cinnamon. (Syn., Tr. Cinnam.; Fr. Teinture de Cannelle; Ger. Zimttinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: glycerin 7.5 Ml. (Cc.), alcohol 67.5 Ml. (Cc.), water 25 Ml. (Cc.). Dose, ʒss–2 (2–8 Ml. (Cc.)).

2. *Pulvis Aromaticus.* Aromatic Powder. (Syn., Pulv. Arom.; Br. Pulvis Cinnamomi Compositus, Compound Powder of Cinnamon; Fr. Poudre aromatique, Poudres des (Épices) Aromates; Ger. Aromatisches Pulver, Gewürzpulver.)

Manufacture: 35 p. c. Triturate cardamom seed (deprived of pericarp) 15 Gm., myristica 15 Gm., Saigon cinnamon 35 Gm., until fine powder, add Jamaica ginger 35 Gm., mix thoroughly. It is light reddish-brown, strong, distinctive aromatic odor; microscopically—

starch grains (ginger), stone cells, sclerenchymatous fibres, crystals of calcium oxalate. Dose, gr. 10–30 (.6–2 Gm.).

Preps.: 1. *Fluidextractum Aromaticum.* Aromatic Fluidextract. (Syn., Fldext. Aromat., Aromatic Fluid Extract, Extractum Aromaticum Fluidum; Fr. Extrait liquide aromatique des Aromates; Ger. (Gewürz) Aromatisches fluidextrakt.)

Manufacture: Similar to Fluidextractum Aconiti, page 202; menstruum: alcohol. Dose, ♏v–30 (.6–2 Ml. (Cc.)).

3. *Tinctura Cardamomi Composita,* 2.5 p. c. 4. *Tinctura Gambir Composita,* 2.5 p. c. 5. *Tinctura Lavandulæ Composita,* 2 p. c. 6. *Tinctura Rhei Aromatica,* 4 p. c.

II. OIL: 1. *Aqua Cinnamomi.* Cinnamon Water. (Syn., Aq. Cinnam.; Fr. Eau de Cannelle; Ger. (Einfaches) Zimtwasser.)

Manufacture: $\frac{1}{5}$ p. c. Similar to Aquæ Aromaticæ; triturate oil .2 Ml. (Cc.) with purified talc 1.5 Gm., recently boiled distilled water q. s. 100 Ml. (Cc.), filter until clear. Dose, ℥ss–1 (15–30 Ml. (Cc.)).

Preps.: 1. *Infusum Digitalis* (1.5 p. c.)—15 p. c. 2. *Mistura Cretæ,* 40 p. c.

2. *Spiritus Cinnamomi.* Spirit of Cinnamon. (Syn., Sp. Cinnam.; Fr. Alcoolat de Cannelle; Ger. Zimtspiritus.)

Manufacture: 10 p. c. Dissolve oil 10 Ml. (Cc.) in alcohol q. s. 100 Ml. (Cc.). Dose, ♏v–30 (.3–2 Ml. (Cc.)).

Prep.: 1. *Syrupus Rhei,* $\frac{2}{5}$ p. c.

3. *Acidum Sulphuricum Aromaticum,* $\frac{1}{10}$ p. c.

Unoff. Preps.: BARK: *Fluidextract,* dose, ♏v–30 (.3–2 Ml. (Cc.)). *Infusion,* dose, ℥j–2 (30–60 Ml. (Cc.)). *Syrup* (bark 10, water 50, sugar 60); for flavoring.

PROPERTIES. — Carminative, stomachic, stimulant, astringent, hæmostatic, aromatic, antispasmodic, germicide. The oil has no astringency.

USES.—Diarrhœa, flatulence, nausea, vomiting, menorrhagia, parturient, to correct griping medicines; for flavoring preparations, chocolate, etc.

Allied Products:

1. *Cinnaldehydum, Cinnamic Aldehyde,* C_9H_8O, official 1900–1910. —Obtained as a natural product by shaking oil of cassia with aqueous solution of acid sodium sulphite, filtering, washing crystalline magma with alcohol, decomposing with diluted sulphuric acid, or synthetically by oxidation of cinnamyl alcohol by dry distillation of a mixture of calcium cinnamate and formate, or as a condensation-product by acting on benzaldehyde (10), acetaldehyde (15) with hydrochloric acid gas, or with 10 p. c. solution of sodium hydroxide (10) + water (900). It is a colorless liquid, cinnamon-like odor, burning, aromatic taste, sp. gr. 1.047, boils at 250° C. (482° F.) with partial decomposition, optically inactive, solidified with ice and salt should melt at —7.5° C. (18.5° F.), soluble in alcohol, ether, fixed or volatile oils, sparingly in water; contains at least 95 p. c. of pure cinnamic aldehyde.

Similar to oil of cinnamon, for which it may be substituted. Should be kept in well-stoppered, small, amber-colored bottles. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

2. *Cinnamomum Cassia* (*aromat'icum*), *Chinese Cinnamon.*—The dried bark of the shoots deprived of most of the corky portion, official 1820–1900; China. Plant—handsome tree, but bark removed when 5–6 years old, occurring in quills 5–20 Mm. ($\frac{1}{5}$–$\frac{4}{5}$′) broad, bark 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, deprived of corky layer, yellowish-brown, often with grayish patches, rough, inside nearly smooth, faintly striate, fracture nearly smooth; odor fragrant; taste sweet, aromatic, pungent, astringent. The outer layers are simply imperfectly removed by curved knives or planes, those of iron being avoided, consequently can be recognized readily by having undergone this treatment, also by its more irregular zone of stone cells, the greater abundance of bast-fibres and tannin. This bark is very irregular in quality, owing to its varied origin, and accordingly is recognized in commerce as Cassia, Cassia vera, Cassia lignea, etc. *C. Burman'ni* is believed to yield the Sumatra, also a portion of the Java, China, Timor; *C. Tam'ala,* some of the Calcutta, N. India, Cochin China; *C. i'ners,* part of E. Indian archipelago.

3. *Cassia Buds, Flores Cassiæ.*—These are the small, stem-like immature fruits of various species, somewhat resembling, but smaller than clove, having fine cinnamon odor and taste; contain oil of cinnamon, tannin, etc.

CAMPHORA. CAMPHOR.

Cinnamomum Camphora, (*Linné*) *Nees et Ebermaier.* { The dextrorotatory ketone (concrete volatile oil).

Habitat. China, Japan, Formosa. Tree cultivated in Italy as an ornament, and may yield profitably in California, Florida, etc., wherever frosts are light.

Syn. Camph., Camphor Laurel, Gum Camphor Tree; Fr. Camphre du Japon —droit; Ger. Kampfer, Kampher, Campfer.

Cam'pho-ra. L. fr. Ar. *kafur* or *kapur,* chalk, lime—*i. e.,* its resemblance.

Plant.—Handsome evergreen tree, 9–12 M. (30–40°) high, .3–.6 M. (1–2°) thick, much branched above, fragrant; bark smooth, green; leaves 7.5–15 Cm. (3–6′) long, 2.5–7.5 Cm. (1–3′) broad, attenuated toward both ends, entire, smooth, shining, ribbed, bright yellowish-green above, paler and glaucous beneath, thick; flowers, June–July, small, whitish; fruit, Nov.–Dec., purple berry, 6 Mm. ($\frac{1}{4}$′) thick, 1-seeded. Dextrorotatory ketone (camphor), in white, translucent masses, granules of tough consistence, penetrating, characteristic odor, pungent, aromatic taste, soluble in alcohol, chloroform, ether, carbon disulphide, petroleum benzin, oil of turpentine, fixed or volatile oils, slightly in water, sp. gr. 0.990; readily pulverized with a little alcohol, chloroform, ether, and liquefied with equal quantity of hydrated chloral, menthol, phenol, thymol; volatilizes at ordinary temperature, melts at 175° C. (347° F.). *Tests:* 1. Heat 2 Gm.—sublimes without carbonization, leaving ash about .05 p. c. 2. Solution in petroleum benzin, 1 in 10—clear (abs. of moisture); alcoholic solution precipitates with water. *Impurities:* Chlorinated products, moisture. Should be kept cool, in well-closed containers. Dose, gr. 1–5 (.06–.3 Gm.).

Commercial.—Tree, resembling sassafras and linden, is of slow growth but flourishes up to 600 M. (2,000°) elevation in the tropics —Cape of Good Hope, Brazil, Jamaica, Madeira, Mediterranean region, etc. The wood is valuable, being white, fragrant and repellent to insects, and while all parts contain camphor, along with its strong odor, it is obtained only from the root, trunk, and branches of trees fifty or more years old—by sublimation. In Japan roots and small branches are chipped and put, with some water, in large vessels surmounted by earthen domes lined with rice-straw; on applying heat the camphor, volatilized by steam, rises to the domes and condenses upon the straw—flowers of camphor—from which it is shaken and packed in double-tubs, 100 pounds (45 Kg.). In China the comminuted plant is boiled with water until camphor adheres to the ladle and the strained liquid concretes upon cooling, which then is sublimed with alternating layers of earth. In Formosa (island) a long wooden

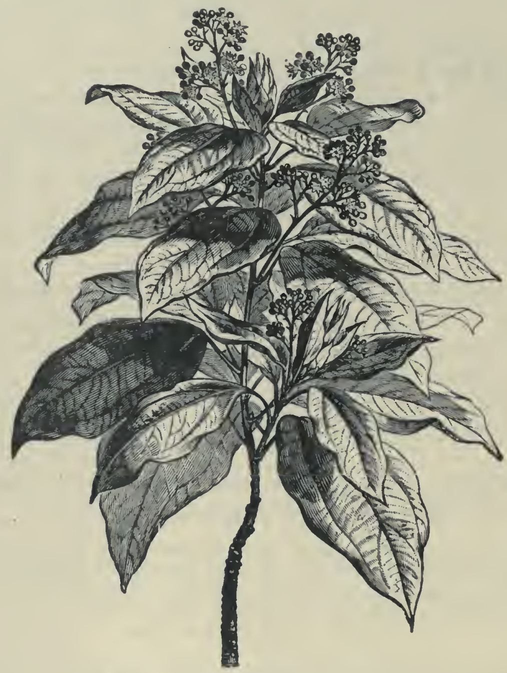


FIG. 143.—*Cinnamomum Camphora.*

trough, coated with clay and fixed over a crude furnace, is half-filled with water and, upon a perforated board luted to the top, chips are placed, that in turn are covered with inverted pots; on applying heat steam is produced, which, rising, passes through the perforations and chips, thereby becoming camphor-vapor that condenses in the upper part of the pots—flowers of camphor—from which it is scraped every few days. It is forwarded in leaf-lined baskets, 70 pounds (32 Kg.), to Tamsui, Takow, etc., there stored in vats, or packed in chests, tubs (lead- or tin-lined), 100 pounds (45 Kg.), which, prior to shipping, are saturated with water to prevent loss of weight by evaporation in transit, causing it to reach us somewhat moist. When in vats a yellowish-brown volatile oil—oil of camphor—drains out, the amount increasing with pressure. There are two varieties: 1, *Japan* (*Tub, Dutch*—they being the first to introduce it), lighter pink, larger grained, higher priced, cleaner, dryer; usually from Batavia; 2, *China* (*Formosa*), cheapest, most abundant; usually from Canton. As such "crude camphor" contains 2–10 p. c. of *impurities*—vegetable matter, gypsum, salt, sulphur, chips, ammonium chloride, chlorinated products, etc.—which must be removed before suitable for medicine.

Refining.—Formerly done exclusively in Europe, but now largely in our country, by mixing crude camphor with $\frac{1}{50}$ part of quicklime (iron filings, sand, or charcoal) to remove resin, empyreumatic oil, moisture, etc., then resubliming at 175–204° C. (347–400° F.) in iron, copper or glass retorts, and pressing into rectangular blocks or circular cakes.

ADULTERATIONS.—Rare: Stearic acid 25–50 p. c., insoluble in alcohol except when hot, crystallizing therefrom upon cooling; cane-sugar 20 p. c.

CONSTITUENTS.—$C_{10}H_{16}O$. When heated with zinc chloride yields cymol, $C_{10}H_{14}$; with nitric acid yields camphoric acid, $C_{10}H_{16}O_4$, and camphoronic acid, $C_9H_{12}O_5$; the former acid forms colorless, inodorous prisms (see page 231); the latter acid melts at 136° C. (277° F.) with decomposition and is freely soluble in water or alcohol.

PREPARATIONS.—1. *Aqua Camphoræ.* Camphor Water. (Syn., Aq. Camph., Aqua Camphorata, Mistura Camphoræ; Fr. Eau camphré; Ger. Kampferwasser.)

Manufacture: $\frac{4}{5}$ p. c. Dissolve .8 Gm. in alcohol .8 Ml. (Cc.), triturate with purified talc 1.5 Gm. until alcohol evaporated, add recently boiled distilled water q. s. 100 Ml. (Cc.), filter repeatedly until clear. Dose, ʒj–8 (4–30 Ml. (Cc.).

2. *Linimentum Camphoræ.* Camphor Liniment. (Syn., Lin. Camph., Camphorated Oil, Linimentum Camphoratum; Fr. (Liniment) Huile camphré; Ger. Oleum Camphoratum, Kampferöl, Kampferliniment.)

Manufacture: 20 p. c. Heat in a flask on water-bath cottonseed oil 80 Gm., add camphor 20 Gm., stopper container and agitate occasionally until dissolved without further heating; used externally.

3. *Spiritus Camphoræ.* Spirit of Camphor. (Syn., Sp. Camph., Tinctura Camphoræ, Tincture of Camphor, Alcohol Camphoratus; Fr. (Esprit de) Alcool camphré; Ger. Spiritus camphoratus, Kampferspiritus.)

Manufacture: 10 p. c. Dissolve 10 Gm. in alcohol q. s. 100 Ml. (Cc.). *Test:* 1. To 5 Ml. (Cc.) add .05 Gm. of anhydrous potassium carbonate—latter does not liquefy or adhere to the bottom of container (abs. of added water). Dose, ♏v–60 (.3–4 Ml. (Cc.)).

4. *Linimentum Belladonnæ,* 5 p. c. 5. *Linimentum Saponis,* 4.5 p. c. 6. *Tinctura Opii Camphorata,* $\frac{2}{5}$ p. c.

Unoff. Preps.: Cerate (camphor liniment (10), white wax (35), white petrolatum (15), benzoinated lard (40)). *Linimentum Camphoræ Ammoniatum* (Br.) 12.5 p. c., + stronger ammonia water 25 p. c. *Ointment* 22 p. c., + white wax 11, lard 67. *Vinum Camphoratum* (each 50 p. c.). *Camphora Phenolata, Camphora Salicylata,* etc. Enters universally into camphor-ice, dentifrices, etc.

PROPERTIES.—Antispasmodic, stimulant, carminative, stomachic, (an)aphrodisiac, antipyretic, nervine, sedative, diaphoretic, rubefacient, resolvent, antiseptic. Has great healing powers; dilates vessels, increases flow of gastric juice and peristalsis.

USES.—Camphor was not known to Greeks or Romans, we having derived it from the Arabians, who use it solely as a refrigerant and to lessen sexual desire. Now employed in hysteria, dysmenorrhœa, nervousness, diarrhœa, colic, flatulence, rheumatism, gout, tenesmus, asthma, cough, coryza, toothache, headache, spasms, chorea, epilepsy, nausea, typhoid condition, mania. Externally as a wash, liniment, or ointment for ulcers, gangrene, scabies, sprains, bruises, rheumatic pains, convulsions.

Poisoning: Have burning pain, vomiting, weak pulse, giddiness, debility, pallor, cold, clammy skin, faintness, confused ideas, delirium, convulsions, death from collapse; does not kill healthy adults. Give water at once if camphor taken in alcoholic solution, induce vomiting, follow with alcohol in small but frequent doses, coffee, cold, arterial sedatives, ether, artificial heat, castor oil; opium and bromides for the convulsions.

Incompatibles: Aconite, acids, neutral salts, water precipitates all solutions.

Synergists: Antispasmodics, alcohol, opium, narcotics, aromatics, all in small quantity.

Allied Products:

1. **Camphora Monobromata. Monobromated Camphor,** $C_{10}H_{15}BrO$, *official.*—(Syn., Bromo-(Brom-)camphor, Bromated (Brominated) Camphor; Fr. Camphre monobromé; Ger. Monobrom-kampfer(-campfer).)

Manufacture: This ortho-monobromcamphor is obtained by heating together in a flask or retort camphor and bromine in molecular proportions (preferably with a little water or chloroform) until reaction ceases, allowing yellowish solution to crystallize, heating until mass becomes white, recrystallizing from alcohol or petroleum benzin. It is in colorless prismatic needles, scales, or powder, mild, characteristic, camphoraceous odor and taste, permanent, decomposed by exposure to sun-light, soluble in alcohol (6.5), chloroform (.5), ether (1.6), almost insoluble in water; melts at 75° C. (167° F.). *Tests:* 1. Heat .1 Gm. + silver nitrate .1 Gm. + nitric acid 2 Ml. (Cc.) + sulphuric acid 2 Ml. (Cc.) until nitrous vapors cease—yellowish precipitate (silver bromide). 2. Shake .5 Gm. with distilled water 10 Ml. (Cc.)—filtrate neutral, + few drops of silver nitrate T. S.—slightly opalescent; incinerate 2 Gm.—ash .05 p. c. Should be kept dark, in well-closed containers. Dose, gr. 1–5 (.06–.3 Gm.), in pill, emulsion.

2. *Acidum Camphoricum, Camphoric Acid,* $C_{10}H_{16}O_4$, official 1900–1910.—This dibasic organic acid is obtained by oxidizing camphor 150 Gm. with hot nitric acid 2000 Ml. (Cc.), until crystallization takes place, dissolving crystals in water (5) containing sodium carbonate, allowing solution of sodium camphorate to crystallize, dissolving crystals in water (10), decomposing with hydrochloric acid, when camphoric acid crystallizes out. It is in colorless, odorless, monoclinic prismatic crystals, plates, acid taste, melting at 187° C. (369° F.), soluble in alcohol, ether, chloroform, fatty oils, water (125). Antihydrotic, antiseptic, intestinal disinfectant, anticatarrhal; bronchitis, catarrh, cystitis, night-sweats of phthisis, diarrhœa, sore throat, pyelitis, eczema, acne. Dose, gr. 5–30 (.3–2 Gm.); locally in 2–6 p. c. aqueous solutions, with 11 p. c. of alcohol to each 1 p. c. of acid.

3. *Borneo, Sumatra,* or *Barus Camphor* (*Dryobal'anops aromat'ica* (*Camphora*)), $C_{10}H_{18}O$, has different odor from official camphor, heavier than water, less volatile, with nitric acid yields ordinary camphor.

4. *Ngai Camphor* (*Blu'mea balsamif'era*).—This is a tall weed of India, China, Formosa. Its camphor has same composition as Borneo, but is lævorotatory, and natively is prized higher than our official.

5. *Artificial Camphor.*—Although this can be made by oxidizing camphene, $C_{10}H_{16}$, with chromic acid mixture, yet the more recent process is based upon the interaction of anhydrous turpentine and anhydrous oxalic acid at 120–130° C. (248–266° F.), resulting in giving borneol, borneol oxalate, borneol formate, camphor, and polymerization products; however, the products terpin hydrate and terpene hydrochloride are recognized generally under this name—the latter being prepared by saturating oil of turpentine, dissolved in twice its volume of carbon disulphide, with hydrochloric acid gas.

6. *Oleum Camphoræ, Camphor Oil,* official 1870–1880.—This is a yellowish-brown volatile oil obtained from camphor by sublimation and expression; has camphor odor and taste, sp. gr. 0.940, dextrorotatory; contains pinene, phellandrene, cineol, dipentene, terpineol, safrol, eugenol, cadinene—at low temperature deposits camphor; used by Chinese for rheumatism, etc. Should not be confounded with

official Linimentum Camphoræ, which also often is called oil of camphor (Ger. Oleum Camphoratum).

Allied Plants:

1. *Nectan'dra Rodiæ'i, Bebeeru Bark.*—The dried bark, official 1860–1880; S. America, Guiana. Large tree, 18–24 M. (60–80°) high, bark ash-gray, smooth, leaves 12.5–15 Cm. (5–6′) long, 5–7.5 Cm. (2–3′) broad, coriaceous, shining; flowers yellowish-white, jasmine odor, wood strong (valuable in shipbuilding); fruit, subpyriform, 5–7.5 Cm. (2–3′) long, bitter. Bark flat pieces 6 Mm. (¼′) thick, .3–.6 M. (1–2°) long, 10–15 Cm. (4–6′) broad, many longitudinal depressions, inside cinnamon-brown, coarsely striate, fracture granular, with stone cells, astringent, bitter; contains beberine (identical with buxine, paracine, and pelosine), siripine; wood has nectandrine. Used as tonic, antiperiodic, febrifuge; intermittents, menorrhagia, leucorrhœa, headache, neuralgia, dyspepsia, consumption, in infusion, decoction. Dose, ʒss–1 (2–4 Gm.); beberine, gr. 1–10 (.06–.6 Gm.).

2. *Coto Bark.*—Bolivia. May be from *Dri'mys Win'teri* var. *granaten'sis.* In flat or curved pieces 12 Mm. (½′) thick, cinnamon color and odor, taste pungent, bitter; contains cotoin, $C_{14}H_{12}O_4$, volatile oil, resin. Dose, gr. 1–5 (.06–.3 Gm.); cotoin, gr. ¾–2 (.05–.13 Gm.).

3. *Paracoto Bark.*—Bolivia. 12 Mm. (½′) thick, sometimes with white fissured cork, odor nutmeg-like; contains paracotoin, $C_{12}H_{18}O_4$, hydrocotoin, volatile oil, resin. Used like coto bark for diarrhœa of typhoid, phthisis, sweating, cholera, nasal catarrh. Dose, gr. 5–10 (.3–.6 Gm.); fluidextract (90 p. c. alcohol); tincture 12.5 p. c. (alcohol), ʒss–1 (2–4 Ml. (Cc.)); paracotoin, gr. 1–5 (.06–.3 Gm.).

4. *Ben'zoin (Lin'dera) Benzoin, Spice* or *Benjamin Bush.*—N. America, damp woods. Shrub 2–4.5 M. (6–15°) high, smooth; bark mostly used, berries and leaves to some extent; tonic, aromatic stimulant, diaphoretic; berries for allspice. Dose, gr. 15–60 (1–4 Gm.).

5. *Lau'rus no'bilis, Laurel, Sweet Bay.*—The leaves and fruit; Mediterranean Basin. Leaves 5–10 Cm. (2–4′) long, pellucid-punctate, smooth, aromatic, astringent; fruit (bayberries) oval drupes 12 Mm. (½′) long; contain volatile oil, fixed oil (Oleum Lauri) 30 p. c.; stimulant, astringent, stomachic.

28. PAPAVERACEÆ. Poppy Family.

Pa-pav-e-ra'se-e. L. *Papaver* + aceæ, poppy, OE, *papy*, Gr. *μήκων*, classic name, fr. *papa*, pap or thick milk—*i. e.*, formerly used for children—to nourish and cause sleep. Herbs, shrubs, with milky or colored juice. Distinguished by the 2–3 fugacious sepals and minute embryo near base of fleshy albumin; flowers large, in 2's or 4's; petals 4–12; stamens 16 +; ovary compound, 1-celled; anthers 2-celled, superior; fruit capsule; temperate climates; narcotic, emetic, cathartic, acrid poison.

Genera: **1. Papaver. 2. Sanguinaria.**

PAPAVERACEÆ

OPIUM. OPIUM.

Papaver { **somniferum,** *Linné,* and var. **album,** *DeCandolle.* }

The air-dried, milky exudation obtained by incising the unripe capsules, containing, when moist, 9.5 p. c. of anhydrous morphine.

Habitat. W. Asia (Asia Minor, Persia, China, Africa, India, Italy, Greece, England, United States; cultivated.

Syn. Opium Poppy, White Poppy, Poppy, Maw (Black, Blue) Seed Poppy, Cheesebowl, Marble-flower; Meconium, Lachryma Papaveris, Succus Thebaicus, Opium Thebaicum, Thebaica; Fr. Opium de Smyrne—thebaicum, Pavot officinal; Ger. Opium, Mohnsaft.

Pa-pa'ver. See etymology, page 232, of Papaveraceæ.
Som-nif'er-um. L. *somnus,* sleep, + *ferre,* to bring—*i. e.,* produces sleep.
Al'bum. L. *albus,* white—*i. e.,* the flowers.
O'pi-um. L. fr. Gr. ὄπιον, poppy or vegetable juice.

Plants.—Erect annuals; stems .6–1.3 M. (2–4°) high, 12 Mm. (½′) thick, solid, smooth, glaucous, green, branched; roots yellow, thick, branched; leaves thick, ovate, cordate, variously toothed, sessile, 15–25 Cm. (6–10′) long, dull green, paler beneath, glaucous, prominent veins, white wide midrib; flowers, Feb.–March, few, large, 7.5–17.5 Cm. (3–7′) broad, terminal, silver-gray; sepals 2, green; petals 4, white (yellow, violet); stamens numerous; fruit capsule, 3–5–20 on each plant, nearly globular, 2.5–7.5 Cm. (1–3′) broad, filled with laticiferous vessels, flat top and bottom, smooth, glaucous neck; pericarp yellowish, dehiscing by small apertures beneath stigmatic crown; seeds numerous, small, white (gray, violet, black). Exudation (opium), in more or less rounded, mostly somewhat flattened masses of variable size, usually 8–15 Cm. (3–6′) broad, grayish-brown, covered with fragments of poppy leaves and at times *Rumex* fruits, adhering from the packing; more or less plastic when fresh, becoming hard and brittle on keeping; internally dark brown, interspersed with lighter areas, somewhat lustrous; odor characteristic, narcotic; taste bitter, characteristic. *Solvents:* diluted alcohol; diluted acids; boiling water. Dose, gr. 1–2 (.06–.13 Gm.).

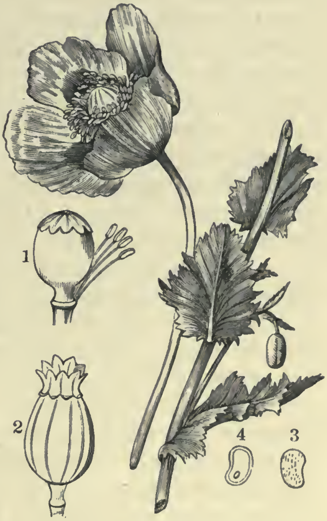


Fig. 144.—*Papaver somniferum: 1,* ovary with few remaining stamens; *2,* ripened capsule; *3,* seed; *4,* longitudinal section of seed.

Adulterations.—Sand, stones, clay, ashes, shot, bullets, charcoal, gypsum, litharge; flour, starch, gums (acacia, tragacanth), sugar, molasses; aloes, pitch, resins, extract of capsules and herbs (Papaver, Lactuca, Glycyrrhiza, Chelidonium), pulp of apricots, figs and grapes;

camel's dung, pounded capsules, leaves, stems, moisture, exhausted opium.

Commercial.—Plant was known to the ancients, Homer mentioning it (poppy) as a medicine and as grown in gardens for strikingly ornamental flowers—a popularity still enjoyed. Seldom found wild as it requires rich soil and manure, timely rains, exact tillage and care until the yielding stage, being planted like our wheat, Sept.–Oct.—winter crop, or (when resowing is necessary through injury from absence of snow as a protection) Feb.–March—spring crop. Cultivation occasions great variability, the stronger, those having whitish petals and seeds, and large capsules (var. *album*) degenerating into the weaker, those having pink, red, purple, blackish petals and seeds, and small capsules (var. *nigrum*), and while all parts yield milk-juice the leaves and seeds are without alkaloids, the former being used natively as spinach, the latter for the 50–60 p. c. of bland yellow oil—an acceptable substitute for olive oil in painting, cookery, pharmacy, etc. Opium is collected chiefly in Asia Minor, Egypt, India, etc., May–July, by making into the unripe pale yellow or light green capsule, a few days after the flower falls, one or more transverse or spiral incisions (longitudinal in Japan, India) with a several bladed knife (nushtur), wetted occasionally with saliva or oil to prevent adherence. The incisions, owing to laticiferous vessels lying just beneath the epidermis, must be only sufficiently deep to obtain all the juice (not through the inner capsular diaphragm which would cause its loss by escaping into the centre of the capsule, as well as damage to seeds and plant), and are made by men, women, and children in the afternoon, yielding at once the white exudation that soon concretes into tears and turns brown by next morning, when it is scraped off (often with 5–8 p. c. of capsular epidermis and other tissues—Smyrna) with a blunt knife onto a poppy or *Rumex* leaf held in the left hand; upon the mass becoming uncomfortably weighty the leaf margins are infolded, then further wrapped if necessary with fresh leaves and dried in the shade for several days, sufficient to avoid moldiness—a very common defect. At this stage collectors may simply press together the separate masses, when a lens easily reveals the agglutinated tears—*granular opium* (Asia Minor, Persia), or the tears may be reduced in a mortar to a uniform mass—*homogeneous opium* (Egypt, India), or the pure juice may be mixed with an aqueous extract of spent capsules and leaves, etc. Small growers dispose of their product to interior merchants, who, to prevent sticking, pack it with *Rumex* capsules in bags, which are sealed, placed in baskets, and forwarded to Smyrna, Constantinople, etc., where it is sold upon physical examination—color, odor, weight, consistence, and appearance affording usually a correct estimate—and transferred to the buyer's underground warehouse to prevent evaporation, or to further cure and manipulate. There are several varieties: 1, *Asia Minor* (*Turkey—P. somniferum,* + var. *album* and *gla'brum*): (*a*) Smyrna—most common in our market; in round, flat lumps, $\frac{1}{2}$–2 pounds (.2–1 Kg.), tears like seeds on inside, also capsular epidermis 5–8 p. c.—evidence of no manipulating, kneading; yield 10–13 p. c. of morphine; (*b*) Constantinople—resembles Smyrna in coming from the same northern opium districts of Anatolia, but without tears and capsular epidermis; in round, flat lumps, ½–3 pounds (.2–1.2 Kg.); yield 10–13 p. c. of morphine; extract 50 p. c.; from same port also comes the rich opiums of Gévé, Magnesia, Salonica, Bithynia, Amasia, Malatia, in packages 1–5 ounces (.03–.15 Kg.); 2, *Egyptian* (*P. somniferum*, + var. *glabrum*); in flat, roundish cakes, 2.5–15 Cm. (1–6′) broad, 2–16 ounces (.06–.5 Kg.), harder, redder, darker and less tenacious than the Smyrna, brittle, conchoidal fracture, waxy lustre, no *Rumex* capsules; not much produced, seldom enters our market; yield 6–7 p. c. of morphine; 3, *Persian* (*Trebizond—P. somniferum*, + var. *album*); usually wrapped in glossy paper having Chinese characters, tied with cotton thread and packed in poppy refuse, cylindrical sticks (resembling mint-candy), 7.5 Cm. (3′) long, 12 Mm. (½′) thick, ½–¾ ounce (15–23 Gm.), or short, rounded cones, balls 6–10 ounces (.18–.3 Kg.), or flat circular cakes, slightly agglutinated, liver-brown like Egyptian, soft in damp weather, very bitter, oily from linseed oil (instead of spittle) used on incising knives; more crystals than Asia Minor; largely doctored; exported to Europe, United States, but mostly to China; yield 8–12 p. c. of morphine; 4, *E. Indian;* wrapped in oiled paper or hard coating of leaves and poppy petals agglutinated with extract of the plant and juice—*Provision opium;* or molded into flat, square, circular cakes—*Abkari opium;* owing to moisture (dews) and delay in making up often ferments, yielding a hard brittle blackish product showing oily spots and conspicuous crystals; does not enter our market—consumed extensively in China; yield 5–7 p. c. of morphine—usually rich in narcotine, 3–4 p. c.; extract 70 p. c.; 5, *Chinese;* wrapped in white paper, flat darkish globular cakes, prepared no doubt by artificial heat, less oily than Persian, entirely consumed at home; annual production 40,000,000 pounds (18,181,800 Kg.), double the combined output of the other varieties, in addition to which the natives consume all of the Indian and much Persian in their vicious practices of smoking and chewing.

The once popular French (Aubergier's, *Affium*—14–23 p. c. of morphine) and Bulgarian (8–20 p. c. of morphine) are practically out of commerce. Opium has been introduced into Algeria and Mozambique (African) for Chinese trade, Bulgaria, Australia, New England, this latter being ruled from trade owing to excessive adulteration, but instead there has been manufactured in our country a "pudding"—so-called *Boston opium*, of high grade appearance but with admixtures reducing it so as just to come within the U. S. P. limit. Plants thrive in Europe and our Southern States (Virginia, S. Carolina, Georgia, Tennessee—hampered mainly by cost of labor), where during the Civil War much opium of high narcotic power was produced under cultivation, being planted in September and collected in May. *Factitious opium* is a blackish aqueous extract of the plant—nearly odorless and tasteless. London is the distributing point, as the English control its production and levy a tax upon its sale for the development of India, etc. Our entrepôts are New York and San Francisco.

CONSTITUENTS.—Morphine (1816) 2.5–15–22.8 p. c., Narcotine (1803–1817) 1.3–10 p. c., Codeine (1832) .2–.7 p. c., Narceine (1832) .02–.1–.7 p. c., Pseudomorphine (1835) .2 p. c., Thebaine (1835) .15–1 p. c., Papaverine (1848) 1 p. c., and 12 other alkaloids, all combined with either sulphuric or meconic acid, 4 p. c.; derivatives—apomorphine, apocodeine, etc.; also contains glucose, mucilage, pectin, caoutchouc, wax, fat, resin, coloring and odorous principles, lactic acid (1.25 p. c.), meconin, $C_{10}H_{10}O_4$, meconoiosin, $C_8H_{10}O_2$, extractive, minerals 6 p. c., ash 6 p. c.

Morphina, Morphine, $C_{17}H_{19}NO_3 + H_2O$, *official.*—(Syn., Morphia, Morphinum; Fr. Morphine; Ger. Morphinum, Morphin.) This, the first alkaloid known, is obtained by exhausting opium with water, concentrating, filtering, adding alcohol, ammonia water, setting aside to crystallize, dissolving crystals in hot alcohol, treating with animal charcoal, crystallizing; or may treat concentrated filtered infusion with calcium chloride, evaporate filtrate, when morphine and codeine crystallize out, narcotine, etc., remaining in mother-liquors; occurs in colorless, or white shining rhombic prisms, or fine needles, or crystalline powder, odorless, bitter, permanent, soluble in water (3340), boiling water (1075), alcohol (210), boiling alcohol (98), chloroform (1220), ether (6250), lime water (100); insoluble in benzene; aqueous solution alkaline; forms numerous salts (acetate, hydrochloride, sulphate, etc.). *Tests:* 1. Add to .05 Gm. sulphuric acid 1 Ml. (Cc.)—no color, reddish, yellowish; on heating changes to brown. 2. With sulphuric acid containing .005 Gm. of selenous acid in each Ml. (Cc.)—blue color, changing to green, brown (codeine yields green color, changing to blue, grass-green; narcotine—green color, changing to brown, cherry-red); with sulphuric acid containing .005 Gm. of molybdic acid in each Ml. (Cc.)—purple color, changing to blue; with sulphuric acid containing 1 drop of formaldehyde solution in each Ml. (Cc.)—intense purple color. 3. With nitric acid—orange-red, fading to yellow; with a few drops of ferric chloride T. S.—blue color, destroyed by acids, alcohol, heating; incinerate .5 Gm.—ash non-weighable. *Impurities:* Codeine, ammonium salts, foreign alkaloids, meconic acid, meconates, moisture. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 Gm.).

Morphinæ Hydrochloridum, Morphine Hydrochloride, $C_{17}H_{19}NO_3.HCl + 3H_2O$, *official.*—(Syn., Morph. Hydrochl., Morphine Chloride, Morphinæ Hydrochloras, Morphinæ Murias; Fr. Chlorhydrate de Morphine; Ger. Morphinum hydrochloricum, Morphinhydrochlorid, Salzsaures Morphin.) Obtained by mixing morphine with boiling distilled water, adding diluted hydrochloric acid until dissolved and neutral, concentrating until crystals appear; occurs in white, silky, glistening needles, cubical masses, or as a white, crystalline powder, odorless, bitter, permanent, soluble in water (17.5), boiling water (.5), alcohol (52), hot alcohol (46), glycerin; insoluble in chloroform, ether; aqueous solution neutral, slightly acid. *Test:* 1. Aqueous solution + silver nitrate T. S.—white precipitate, insoluble in nitric acid. *Impurities:* Apomorphine, moisture, etc. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 Gm.).

Morphinæ Sulphas, Morphine Sulphate, $(C_{17}H_{19}NO_3)_2.H_2SO + 5H_2O$, *official.*—(Syn., Morph. Sulph., Morphiæ Sulphas, Sulphas (Sulfas) Morphicus; Fr. Sulfate de Morphine; Ger. Morphinum sulfuricum, Morphinsulfat, Schwefelsaures Morphin.) Obtained by mixing morphine (1) with boiling water (2), adding diluted sulphuric acid until dissolved and neutral, setting aside to crystallize; occurs in white, feathery, acicular, silky crystals, or in cubical masses, odorless, bitter, permanent, soluble in water (15.5), hot water (.7), alcohol (565), hot alcohol (240); insoluble in chloroform, ether; aqueous solution (1 in 20) neutral, slightly acid. *Test:* 1. Aqueous solution + barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. *Impurities:* Moisture, etc. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 Gm.).

Æthylmorphinæ Hydrochloridum, Ethylmorphine Hydrochloride, $C_{17}H_{18}NO_3C_2H_5HCl + 2H_2O$, *official.*—(Syn., Æthylmorph. Hydrochl., Ethylmorphine Chloride, Dionin; Fr. Chlorhydrate d'ethylmorphine; Ger. Salzsaure Morphinæthylæther). This hydrochloride of an alkaloid prepared from morphine by ethylation is obtained by the action of ethyl iodide on an alkaline solution of morphine, thereby forming ethylmorphine (codethyline), neutralizing the new base with hydrochloric acid. It is a white, yellowish, odorless, microcrystalline powder, soluble in water (8), alcohol (22), slightly in ether, chloroform; aqueous solution neutral; melts at 123° C. (254° F.) with decomposition. *Tests:* 1. Dissolve .01 Gm. in 10 Ml. (Cc.) of sulphuric acid, + a drop of ferric chloride T. S., warm—green, then deep violet-blue, turning deep red with nitric acid. 2. Aqueous solution + silver nitrate T. S. —white precipitate, insoluble in nitric acid. 3. Incinerate .2 Gm. —ash non-weighable. *Impurities:* Ammonium compounds, morphine, etc. Produces no constipation, nausea, lassitude, tolerance, otherwise similar to morphine. Dose, gr. $\frac{1}{4}$–$\frac{1}{2}$ (.016–.03 Gm.), tablet, suppository; externally 10–20 p. c. solutions.

Apomorphinæ Hydrochloridum, Apomorphine Hydrochloride, $C_{17}H_{17}NO_2HCl + \frac{1}{2}H_2O$, *official.*—(Syn., Apomorph. Hydrochl., Apomorphine Chloride, Apomorphinæ Hydrochloras; Fr. Chlorhydrate d'Apomorphine; Ger. Apomorphinum hydrochloricum, Apomorphinhydrochlorid.) This hydrochloride of the artificial alkaloid is prepared by heating morphine or codeine (1) with pure hydrochloric acid (20) in a sealed glass tube 2–3 hours at 149° C. (300° F.), cooling liquid contents, adding excess of sodium bicarbonate to precipitate apomorphine, treating precipitate with ether or chloroform, adding a little hydrochloric acid, when crystals form; it is morphine deprived of one molecule of water; occurs in minute, grayish-white, glistening, monoclinic prisms, odorless, slightly bitter taste, greenish upon exposure, soluble in water (50), hot water (17), alcohol (50), slightly in chloroform, ether; aqueous solution neutral; over sulphuric acid loses water of crystallization, regaining it on exposure. *Tests:* 1. Aqueous solution + sodium bicarbonate solution—white, greenish-white precipitate, green on exposure, dissolving in ether (violet), chloroform (violet-blue). 2. Aqueous solution + silver nitrate T. S.—white precipitate, insoluble in nitric acid, black by reduction to metallic silver—instantly reduced by ammonia water. 3. Incinerate .2 Gm.—ash non-weighable; salt dissolves in nitric acid—purple. *Impurities:* Decomposition products. Should be kept dark, in small, well-stoppered vials, having been rinsed with hydrochloric acid and dried; should be rejected if shaking with water (100) produces at once an emerald-green; solutions should be made freshly with a little hydrochloric or acetic acid to prevent decomposition. Dose, expectorant, gr. $\frac{1}{40}$–$\frac{1}{25}$ (.0015–.0025 Gm.); emetic, gr. $\frac{1}{16}$–$\frac{1}{8}$ (.004–.008 Gm.).

Diacetylmorphina, Diacetylmorphine, $C_{17}H_{17}NO(C_2H_3O_2)_2$, *official.*—(Syn., Diacetylmorph., Heroine, Diacetic ester of Morphine; Br. Diamorphine; Fr. Heroine; Ger. Diacetylmorphin.) This alkaloid is prepared from morphine by acetylization—heating morphine with acetyl chloride, washing product with water, then with dilute solution of sodium carbonate, purifying by crystallization from hot alcohol. It is a white, crystalline, odorless powder, soluble in water (1700), alcohol (31), chloroform (1.4), ether (100); saturated alcoholic solution alkaline, melts at 172° C. (342° F.). *Tests:* 1. Dissolve .01 Gm. in a few drops of nitric acid—yellow color, changing to greenish-blue. 2. Heat .1 Gm. + alcohol 1 Ml. (Cc.) + sulphuric acid 1 Ml. (Cc.)—produces ethyl acetate, recognized by odor; incinerate .5 Gm.—ash non-weighable. *Impurities:* Morphine, foreign alkaloids, ammonium salts, readily carbonizable organic substances. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{24}$–$\frac{1}{12}$ (.0025–.005 Gm.).

Diacetylmorphinæ Hydrochloridum, Diacetylmorphine Hydrochloride, $C_{17}H_{17}NO(C_2H_3O_2)_2.HCl + H_2O$, *official.*—(Syn., Diacetylmorph. Hydrochl., Diacetylmorphine Chloride, Heroinæ Hydrochloridum; Br. Diamorphine Hydrochloride; Fr. Chlorhydrate d'heroine; Ger. Diacetylmorphin (Heroin) hydrochlorid, Salzsaures Heroin.) This hydrochloride of the (artificial) alkaloid is prepared by dissolving diacetylmorphine crystals in dilute hydrochloric acid, concentrating, setting aside to crystallize. It is a white, crystalline, odorless powder, soluble in water (2), alcohol, insoluble in chloroform, ether; aqueous solution neutral, faintly acid, melts at 230° C. (446° F.) with decomposition. *Tests:* 1. Aqueous solution, + silver nitrate T. S.—white precipitate, insoluble in nitric acid. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{24}$–$\frac{1}{12}$ (.0025–.005 Gm.), 3–4 times daily; 2 p. c. solution hypodermically.

Codeina, Codeine, $C_{17}H_{18}(CH_3)NO_3+H_2O$, *official.*—(Syn., Codein., Codeia, Methylmorphine; Fr. Codéine; Ger. Codeïnum, Kodein, Codein.) Obtained from opium by precipitating infusion with chalk and calcium chloride, when chlorides of morphine and codeine crystallize out; dissolve these in water, add ammonia, when morphine crystallizes, evaporate filtrate for codeine; if instead of ammonia we use potassium or sodium hydroxide, codeine will be precipitated and morphine remain in solution; may obtain it also synthetically from morphine by methylation—acting upon alkaline solution of morphine with methyl iodide or chloride, or sodium methylsulphate, hence it is methylmorphine. It is in colorless, translucent, rhombic prisms, crystalline powder; odorless, slightly efflorescent in warm air, soluble in water (120), alcohol (2), warm alcohol (1.2), chloroform (.5), ether (18); aqueous solution alkaline, lævorotatory; when anhydrous melts at 155° C. (311° F.); heated with insufficient water to dissolve melts to oily drops, crystallizing on cooling. *Tests:* 1. With sulphuric acid containing .005 Gm. of selenious acid in each Ml. (Cc.)—green, rapidly blue, slowly grass-green. 2. Dissolve .01 Gm. in sulphuric acid 5 Ml. (Cc.)—transient pink, + a drop of ferric chloride T. S.—blue when warmed, changing to red with a drop of nitric acid; dry to constant weight—loses 6 p. c.; incinerate .5 Gm.—ash non-weighable. *Impurities:* Morphine, etc. Should be kept dark, in well-closed containers. Dose, gr. ½–2 (.03–.13 Gm.).

Codeinæ Phosphas, Codeine Phosphate, $C_{18}H_{21}NO_3H_3PO_4 + 2H_2O$, *official.*—(Syn., Codein. Phos.; Fr. Phosphate de Codéine; Ger. Codeïnum phosphoricum, Kodeinphosphate.) Obtained by dissolving codeine (10) in 25 p. c. phosphoric acid (12.5), leaving solution slightly acid, and adding alcohol sufficient to precipitate. It is in fine, white, needle-shaped crystals, crystalline powder; odorless, very efflorescent, soluble in water (2.3), hot water (.5), alcohol (325), boiling alcohol (125), chloroform (4500), ether (1875); aqueous solution acid. *Tests:* 1. Aqueous solution neutralizing with ammonia water, + silver nitrate T. S.—yellow precipitate, soluble in diluted nitric acid or ammonia water. *Impurities:* Chlorides, sulphates. Considered the best salt for hypodermic use, as it is more soluble and less irritating. Should be kept dark, in well-closed containers. Dose, gr. ½–2 (.03–.13 Gm.); injection, gr. ⅓–¾ (.02–.05 Gm.).

Codeinæ Sulphas, Codeine Sulphate, $(C_{18}H_{21}NO_3)_2H_2SO_4 + 5H_2O$, *official.*—(Syn., Codein. Sulph.; Fr. Sulfate de Codéine; Ger. Codeïnum sulfuricum, Kodeinsulfat.) Obtained by dissolving codeine 100 Gm. in warm water, adding sufficient sulphuric acid (16.54 Gm.) to get neutral liquid, concentrating, allowing to crystallize. It is in long, glistening, white, needle-shaped crystals, rhombic prisms, crystalline powder; odorless, efflorescent, soluble in water (30), hot water (6.5), alcohol (1280), warm alcohol (440), insoluble in chloroform, ether; aqueous solution faintly acid. *Tests:* 1. Aqueous solution + barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. 2. Dry to constant weight at 100° C. (212° F.)—loses 12 p. c. *Impurities:* Morphine, etc. Should be kept dark, in well-closed containers. Dose, gr. ½–2 (.03–.13 Gm.).

Narcotine, $C_{22}H_{23}NO_7$.—Obtained from an aqueous solution by shaking, or from opium itself by macerating with ether or chloroform; occurs in tasteless, colorless, shining, rhombic crystals; soluble in ether, chloroform, benzene, hot alkaline solutions; dissolves blood-red in sulphuric acid containing some nitric acid; heated with nitric acid gives meconin, $C_{10}H_{10}O_4$, cotarnine, $C_{12}H_{13}NO_3$, and opianic acid, $C_{10}H_{10}O_5$; forms salts (hydrochloride, sulphate, etc.). Dose, gr. 1–3 (.06–.2 Gm.).

Cotarninæ Hydrochloridum, Cotarnine Hydrochloride, $C_{12}H_{14}NO_3Cl$, *official.*—(Syn., Cotarn. Hydrochl., Cotarnine Chloride, Stypticin;

Fr. Chlorhydrate de Cotarnine; Ger. Cotarninhydrochlorid.) This quaternary oxymethyl-oxymethylene-dihydro-isoquinoline chloride is an oxidation product, similar to hydrastinine, obtained by hydrolyzing narcotine—boiling it with water for a long time, or heating it with diluted nitric acid, precipitating with potassium hydroxide solution, dissolving the resulting cotarnine in diluted hydrochloric acid, crystallizing. It is a yellow crystalline powder, odorless, bitter, deliquescent in moist air, very soluble in water, alcohol (yellow solutions); aqueous solution neutral. *Tests:* 1. Aqueous solution, + silver nitrate T. S.—white precipitate, insoluble in nitric acid. 2. Dissolve .2 Gm. in 10 Ml. (Cc.) of distilled water, + 10 Ml. (Cc.) of $\frac{N}{10}$ iodine V. S.—brown precipitate (cotarnine periodide), which, when dried, melts at 143° C. (290° F.). 3. Heat gradually .1 Gm.—decomposes, evolving characteristic, disagreeable vapors and yielding a reddish-brown liquid, changing to hard charred mass; incinerate mass—ash non-weighable. 4. Dissolve .5 Gm. in 10 Ml. (Cc.) of distilled water, add 2 Ml. (Cc.) of aqueous solution of sodium hydroxide (15 p. c.)—milk-white precipitate, dissolved on agitation, reprecipitated on standing. Dose, gr. $\frac{1}{2}$–1 (.03–.06 Gm.), 4–5 times daily, in coated tablet, pill, capsule; hypodermic, ♏30 (2 Ml. (Cc.)) of 10 p. c. solution; externally, pure or strong solution. Cotarnine Phthalate, Styptol, $(C_{12}H_{13}NO_3)_2C_6H_4(CO_2H)_2$—similar to the official salt, Cotarnine Hydrochloride, yellow microcrystalline powder, soluble in water; hæmostatic, sedative—uterine hemorrhage. Dose, gr. $\frac{1}{2}$–1 (.03–.06 Gm.), 4–5 times daily.

Narceine, $C_{23}H_{29}NO_9$.—Long, silky needles, bitter, sparingly soluble in cold alcohol and water, insoluble in ether; with warm diluted sulphuric acid—violet and cherry-red; with nitric acid—transiently yellow; with iodine—blue; with Fröhde's reagent—brown-yellow; forms salts (hydrochloride, nitrate, sulphate, etc.). Dose, gr. $\frac{1}{3}$–$\frac{3}{4}$ (.02–.05 Gm.).

The four alkaloids, morphine, codeine, narcotine, and narceine, may be extracted from any given sample of opium by shaking the concentrated infusion with ether—taking out narcotine; adding alkali in excess to filtrate—redissolving morphine and narceine, leaving codeine deposited; allowing morphine to crystallize from filtrate, and having narceine in mother-liquor, to be obtained by evaporation.

Meconic Acid, $C_7H_4O_7$.—Occurs free and in combination with the alkaloids, being obtained by adding calcium chloride to opium infusion, washing this precipitate (calcium meconate) with hot water, alcohol, and treating with hydrochloric acid, when the filtrate deposits meconic acid upon cooling. *Tests:* 1. With ferric chloride T. S.—blood-red color, not discharged by dilute hydrochloric acid (dif. from acetic and formic acids), or by chlorides of gold or mercury (dif. from sulphocyanates).

Deodorized, granulated, and powdered opiums of a higher grade may be reduced with a lower, or with an inert diluent, to the required strength; or a proportionately less quantity of the higher percentage may be used direct in making preparations; thus of 15 p. c. opium only 66⅔ Gm. need be employed where the U. S. P. directs 100 Gm.—15 : 10 :: 100 : x, or $x = 66.67$.

PREPARATIONS.—1. *Extractum Opii.* Extract of Opium. (Syn., Ext. Opii., Powdered Extract of Opium, Aqueous Extract of Opium, Extractum Thebaicum; Fr. Extrait (d'Opium) thébaïque; Ger. Opiumextrakt.)

Manufacture: Macerate until softened 100 Gm. with hot water 300 Ml. (Cc.), rub to smooth paste, add clean white sand 100 Gm., mix thoroughly, percolate with water until exhausted, evaporate on water-bath to dryness, pulverize; after assay add enough dried starch for extract to contain 20 p. c. of anhydrous morphine, mix thoroughly, pass through fine sieve; contains 19.5–20.5 p. c. of anhydrous morphine; 1 Gm. represents about 2 Gm. of opium. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. ¼–1 (.016–.06 Gm.).

2. *Opium Granulatum.* Granulated Opium. (Syn., Opium Gran.; Fr. Opium Grenelé; Ger. Granulirtes Opium.)

Manufacture: Dry opium, convenient quantity, at 70° C. (158° F.), reduce it to a coarse (No. 8–20) powder; contains 10–10.5 p. c. of anhydrous morphine. Should be kept in well-closed containers. Dose, gr. 1–2 (.06–.13 Gm.).

Preps.: 1. *Tinctura Opii.* Tincture of Opium. (Syn., Tr. Opii, Laudanum, Tinctura (Meconii) Thebaica; Fr. Teinture d'Opium (de Extrait d'Opium)—thébaïque; Ger. Tinctura Opii Simplex, Einfache Opiumtinktur.)

Manufacture: 10 p. c. Pour boiling water 40 Ml. (Cc.) on granulated opium 10 Gm., in a tared vessel, weigh, stir occasionally for 24 hours, add water to restore loss, add alcohol 40 Ml. (Cc.), pour into a bottle, macerate 48 hours, occasionally shaking, percolate, returning first portion until clear, finish with diluted alcohol q. s. 95 Ml. (Cc.), assay, and add enough diluted alcohol for the 100 Ml. (Cc.) to contain .95–1.05—1 Gm. of anhydrous morphine. Dose, ♏v–20 (.3–1.3 Ml. (Cc.)).

2. *Tinctura Opii Deodorati.* Tincture of Deodorized Opium. (Syn., Tr. Opii Deod.; Fr. Teinture d'Opium sans odeur; Ger. Desodorirte Opiumtinktur.)

Manufacture: 10 p. c. Pour boiling water 50 Ml. (Cc.) on granulated opium 10 Gm., stir frequently for 24 hours, percolate, returning first portion until clear, continue with water until exhausted, evaporate to 15 Ml. (Cc.), cool, transfer to bottle, add purified petroleum benzin 6.5 Ml. (Cc.), stopper, shake frequently for 10 minutes, separate and discard benzin layer, shake again with purified petroleum benzin 1 Ml. (Cc.), separate and discard benzin layer, evaporate from residue, in warm place, spontaneously and cautious heat, traces of benzin, add water 60 Ml. (Cc.), filter, add alcohol 20 Ml. (Cc.), wash filter with water q. s. 95 Ml. (Cc.), assay, and add enough water for the 100 Ml. (Cc.) to contain .95–1.05—1 Gm. of anhydrous morphine. Dose, ♏v–20 (.3–1.3 Ml. (Cc.)).

3. *Opii Pulvis.* Powdered Opium. (Syn., Opii Pulv.; Fr. Poudre d'Opium; Ger. Opium pulveratum, Opiumpulver.)

Manufacture: Dry opium, convenient quantity, at 70° C. (158° F.), reduce it to a very fine powder; contains 10–10.5 p. c. of anhydrous morphine. It is light brown; microscopically—chiefly yellowish-brown, brownish-red, irregular and granular fragments, .015–.15 Mm. ($\frac{1}{1650}$–$\frac{1}{165}$′) broad, few fragments of strongly lignified, thick-walled, 4–5-sided or narrowly elongated epidermal cells of poppy capsules, also tissues of poppy leaves, capsules and rumex fruits. Should be kept in well-closed containers. Dose, gr. 1–2 (.06–.13 Gm.).

Preps.: 1. *Pulvis Ipecacuanhæ et Opii.* Powder of Ipecac and Opium. (Syn., Pulv. Ipecac. et Opii., Compound Powder of Ipecac, Dover's Powder; Br. Pulvis Ipecacuanhæ Compositus; Fr. Poudre d'Ipécacuanha opiacée—de Dover; Ger. Pulvis Ipecacuanhæ opiatus, Doversches Pulver, Pulvis Doveri.)

Manufacture: 10 p. c. Triturate together ipecac 10 Gm., powdered opium 10 Gm., sugar of milk 80 Gm.; reduce to fine uniform powder. It is grayish-white, light brown; microscopically—angular, cone-shaped fragments soluble in water or hydrated chloral T. S., strongly polarizing light with display of colors (sugar of milk), numerous tracheids and starch grains of ipecac, .003–.017 Mm. ($\frac{1}{8325}$–$\frac{1}{1475}$′) broad, stone cells of opium (poppy) capsules. Dose, gr. 5–10 (.3–.6 Gm.).

2. *Tinctura Opii Camphorata.* Camphorated Tincture of Opium. (Syn., Tr. Opii Camph., Paregoric, Paregoric Elixir; Br. Tinctura Camphoræ Composita, Compound Tincture of Camphor; Fr. Élixir Parégorique—d'Opium Benzoïque, Teinture d'Opium camphrée; Ger. Tinctura Opii benzoïca, Benzoësaürehaltige Opiumtinktur.)

Manufacture: $\frac{2}{5}$ p. c. Similar to Tinctura Aloes, page 110—macerating powdered opium .4 Gm., benzoic acid .4 Gm., camphor .4 Gm., oil of anise .4 Ml. (Cc.), in glycerin 4 Ml. (Cc.), diluted alcohol 95 Ml. (Cc.), finishing with diluted alcohol q. s. 100 Ml. (Cc.). Dose, ʒss–2 (2–8 Ml. (Cc.)).

Prep.: 1. *Mistura Glycyrrhizæ Composita,* 12 p. c.

3. *Opium Deodoratum.* Deodorized Opium. (Syn., Opium Deod., Opium Denarcotisatum; Fr. Opium (Denarcotine) sans Odeur; Ger. Desodorirtes (Denarcotinirtes) Opium.)

Manufacture: Macerate for 24 hours powdered opium 100 Gm. with sufficient purified petroleum benzin to cover it, shake occasionally, decant clear benzin layer, repeat treatment with fresh benzin, decant as before, percolate residue with fresh benzin until it passes through without color; expose powder to open air to dry, add sugar of milk q. s. to restore original weight; contains 10–10.5 p. c. of anhydrous morphine. Benzin is preferable to ether, as it removes the odorous matter (caoutchouc, wax, fat, etc., that often causes nausea and discomfort) without affecting the narcotine. Should be kept in well-closed containers. Dose, gr. 1–2 (.06–.13 Gm.).

Unoff. Preps.: Compound Liniment, 1 p. c., + camphor 1.75, ammonia water 35, oil of turpentine 22, alcohol 25. *Extractum Opii Liquidum* (Br. 3.75 p. c. of extract). *Linimentum Opii* (Br. 50 p. c. of tincture). *Pills,* 1 gr. (.06 Gm.), dose, 1–2. *Plaster. Pulvis Opii Compositus* (Br. 10 p. c.). *Tincture of Ipecac and Opium,* āā 10 p. c. (diluted alcohol), dose, ♏v–20 (.3–1.3 Ml. (Cc.)). *Tinctura Opii Ammoniata* (Br. 10 p. c. of tincture). *Troches of Glycyrrhiza and Opium,* $\frac{1}{13}$ gr. (.005 Gm.). *Vinegar* (Black Drop), 10 p. c., dose, ♏v–20 (.3–1.3 Ml. (Cc.)). *Wine,* 10 p. c., dose, ♏v–20 (.3–1.3 Ml. (Cc.)). *Chlorodyne* (morphine hydrochloride .5 Gm., water 2 Ml. (Cc.), diluted hydrochloric acid 2, chloroform 6, tincture of cannabis 4, diluted hydrocyanic acid 1, alcohol 16, oil of peppermint 1, oleoresin of capsicum .05, dose, ♏v–15 (.3–1 Ml. (Cc.)), in water—poisonous. *Compound Powder of Morphine* (Tully's Powder, 1.5 p. c., dose, gr. v–10 (.3–.6 Gm. *Injectio Apomorphinæ Hypodermica* (Br.), 1 p. c. *Injectio Morphinæ Hypodermica* (Br.), 2.5 p. c. *Liquor Morphinæ Sulphatis* (U. S. P. 1870, $\frac{1}{4}$ p. c., dose, ʒj–2 (4–8 Ml. (Cc.)). *Liquor Morphinæ Acetatis* (Br.), 1 p. c. *Liquor Morphinæ Hydrochloridi* (Br.), 1 p. c. *Liquor Morphinæ Tartratis* (Br.), 1 p. c. *Majendie's Solution of Morphine,* 4 p. c. (adding $\frac{2}{3}$ p. c. of benzoic acid or phenol prevents spoiling and hypodermic irritation), dose, ♏v–10 (.3–.6 Ml. (Cc.)). *Oleate of Morphine,* 10 p. c. (oleic acid 90 p. c.)—use externally. *Suppositoria Morphinæ* (Br.), $\frac{1}{4}$ gr. (.017 Gm.). *Syrupus Codeinæ Phosphatis* (Br.), .5 p. c. *Troches of Morphine and Ipecac* ($\frac{1}{40}$ gr. (.0016 Gm.) + ipecac $\frac{1}{13}$ gr. (.005 Gm.). *Trochiscus Morphinæ* (Br.), $\frac{1}{32}$ gr. (.002 Gm.).

PROPERTIES.—Narcotic, sedative, anodyne, antispasmodic, hypnotic, diaphoretic, chiefly due to morphine. Codeine—hypnotic, tetanic, less constipating and active than morphine, often contaminated with other alkaloids; used for bronchial coughs, diabetes, etc. Narcotine—antiperiodic, tetanizing, hypnotic without being narcotic, hence name should have been anarcotine. Narceine resembles morphine, but is more hypnotic, with less after-effects—headache, constipation, etc. Apomorphine—stimulant to brain (vomiting) centres, heart; our most useful emetic (hypodermically) in narcotic poisoning, removing foreign bodies from bronchi, etc., sedative expectorant; large amounts depress, produce tetanic convulsions. Diacetylmorphine—lessens irritability of respiratory centre, allays cough, but does not depress like morphine; neither analgesic nor hypnotic; dyspnœa, catarrhal coughs, phthisis, angina, bronchitis, asthma, whooping-cough, hay fever. *Poisoning:* Syncope, suppressed vision, myosis, abnormal temperature have been produced by gr. 3 (.2 Gm.)—antagonize by hypodermic camphor, caffeine, and hot coffee by stomach. Cotarnine—hæmostatic, analgesic, uterine sedative, styptic; dysmenorrhœa, hemorrhages (bladder, nose, extraction of teeth, etc.), menorrhagia, etc. Thebaine (paramorphine)—soporific, spinal excitant, tetanizer, resembling strychnine. Dose, gr. $\frac{1}{2}$–$\frac{3}{4}$ (.03–.05 Gm.). Papaverine—hypnotic, sedative; diarrhœa of children. Dose, gr. $\frac{1}{12}$–$\frac{1}{2}$ (.005–.03 Gm.).

Opium in full doses, gr. 1–3 (.06–.2 Gm.), produces dry mouth, thirst, stimulates brain by increasing blood supply, arrests digestion by reducing bile, gastric and pancreatic juice secretion; causes nausea, vomiting, sweating, depressed circulation and respiration, lower temperature, contracted pupil, retention of urine, profound sopor, or, instead, coma-vigil and delirium with delightful dreams. After-effects are nausea, depression, constipation, headache, vertigo, nasal pruritus.

Uses.—To relieve pain, except in acute inflammation of the brain; to cause sleep in insomnia of low fevers; to allay irritation, to check secretions—diarrhœa, dysentery, diabetes; to support system in low fevers, etc.; also for peritonitis, cerebrospinal meningitis, cholera morbus, delirium tremens, mania spasms, melancholia, sciatica, neuralgia, cancer, renal and hepatic colic from calculi, cough without secretion; to lock bowels when required by inflammation, hemorrhages, dyspnœa, angina pectoris, cerebral anæmia; morphine hypodermically for consumption, chronic catarrh, asthma, diabetes, typhoid fever, dysenteric tenesmus, epilepsy, hysteria, croup, bronchitis, dysmenorrhœa. Externally opium applied in poultices for gout, rheumatism, ophthalmia, odontalgia, periodontitis, inflamed gums and mucous membrane of mouth. Young children are very susceptible to its narcotic effects, to whom it should be given cautiously, women are affected much easier than men, and some individuals possess idiosyncrasy toward it, being on the one hand easily, on the other with difficulty, brought under its influence; others cannot tolerate the smallest dose, while many animals accept it *ad libitum*—ducks, chickens, pigeons, monkeys, etc.

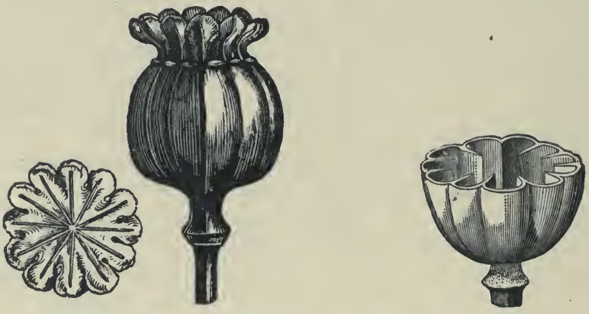


Fig. 145.—Poppy capsule, showing internal septa.

Poisoning: Have mental excitement, increased heart action, slow, irregular, stertorous breathing, cold, clammy sweats, headache, deep sleep, contracted pupils, face reddened, then bluish, slow pulse and dilated pupils as the end approaches, lost reflexes; jaw falls, muscular relaxation, coma, death finally by paralyzed respiration; the more contracted the pupils, the more serious, while vomiting and free perspiration are favorable symptoms. In apoplexy pupils are unequal, in alcoholism they are normal or dilated, in chloroform widely dilated; the odor of breath and vomited matter will often aid diagnosis. Give tannic acid or vegetable astringents (strong coffee or tea), then evacuate the stomach (pump, apomorphine, zinc sulphate, ipecac, etc.), or wash it out with a warm solution of potassium permanganate (using twice the amount of salt as of morphine ingested, then atropine (strychnine), caffeine, cocaine, digitalis, brandy, spirit of nitrous ether, amyl nitrite) to maintain circulation and respiration; faradization, cold douches, ambulation, flagellation; it is eliminated by the kidneys, consequently catheterize the bladder often to prevent reabsorption, and keep the patient awake.

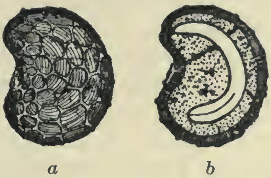


FIG. 146.—Poppy seed, magnified 12 times: *a*, the outside; *b*, longitudinal section showing embryo.

Incompatibles: Alkalies, alkaline carbonates, lime water, tannic acid and vegetable preparations containing it, salts of lead, iron, copper, mercury, and zinc, Fowler's solution, atropine, strychnine, coffee, caffeine, tartar emetic, digitalis; with morphine: iodine, iodides, bromine, bromides, sodium borate.

Synergists: Alcohol, hydrated chloral, belladonna, cocaine, ipecac.

Opium-habit (*Disease*)*:* To this, thousands of weak and strong-minded have fallen prey, including such eminent characters as Coleridge, Robert Hall, John Randolph, De Quincey, Wilkie Collins, etc. By some thought to be a habit, which may be cured by gradually lessening the quantity or by stopping off abruptly, substituting for a time tonics, hyoscine and stimulants—ginger, capsicum, black pepper, quassia, calumba, diluted phosphoric acid, tincture lupulin, etc. Others consider it a disease amenable to systematic systemic treatment in hospitals, etc., where mainly hygiene, tonics, strychnine, atropine, quinine, iron and gold salts are relied upon. Decoction of Sumatra climber, *Combre'tum sunda'icum,* is claimed to be valuable.

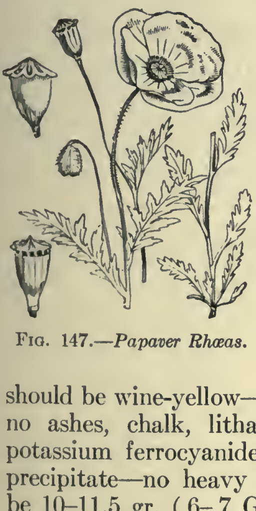


FIG. 147.—*Papaver Rhœas.*

Opium-test: Heat the gum, which, becoming fluid, runs when tilted from dung, mineral and vegetable matters, evaporate heavy liquid to a powder; of this take 25 gr. (1.6 Gm.) + water ʒiv (15 Ml. (Cc.)), triturate, if stiff or mucilaginous—starch, flour, gum, salep; add water ℥ij (60 Ml. (Cc.)), filtrate should be wine-yellow—no extract licorice; mixture should be acid—no ashes, chalk, litharge; evaporate to ℥j (30 Ml. (Cc.)), add potassium ferrocyanide or twice quantity alcohol, should get no precipitate—no heavy metal or gums; the insoluble residue should be 10–11.5 gr. (.6–.7 Gm.), or 100 parts should yield 55–60 parts of aqueous extract.

Allied Products:

1. *Papaveris Capsulæ, Poppy Capsules, Papaver, Poppy.*—The nearly ripe capsules, official 1840–1880. These are collected in August–September, when nearly ripe, inverted to keep the juice from escaping, and dried in kilns for about 12 hours; from these, deprived of seeds, may make an extract and syrup, and, including the seeds, a decoction. Capsules or heads are the size of a hen's egg to one's fist, and contain morphine .2–2 p. c.; syrup (syrupus papaveris), 10 p. c.—coughs, etc.; decoction—demulcent to sprains, bruises, etc.

2. *Seeds.*—When black called *maw* seed; not narcotic, yield 40–60 p. c. fixed oil, which is used as food, for burning in lamps, by painters, instead of olive oil; expressed (oil) cake for cattle, seeds for birds.

3. *Exhausted gum.*—For poultices as anodyne applications.

Allied Plants:

1. *Papaver Rhœ'as, Rhœados Petala, Red Poppy Petals* Br.).—Europe; flowers large, beautiful red, petals mainly used for their coloring matter, which is yielded to water; its milky juice is sedative, demulcent, mild anodyne, probably due to *rhœadine,* also contains two coloring principles—rhœadic and papaveric acids. Syrupus Rhœados (Br.), 26 p. c. Dose, ʒss–1 (2–4 Ml. (Cc.)).

2. *Argemo'ne mexica'na, Prickly Poppy.*—Capsules and leaves contain berberine, fumarine, but no morphine; seeds have a bland, light yellow fixed oil 36 p. c.; substitute for castor oil. Dose, ♏xv–45 (1–3 Ml. (Cc.))

SANGUINARIA. SANGUINARIA.

Sanguinaria canadensis, *Linné.* } The dried rhizome and roots.

Habitat. N. America—Canada, United States, in shaded situations, on rich soil.

Syn. Sanguin., Blood Root, Red (Root, Puccoon) Indian Paint, Puccoon (Coon) Root, Snake-bite, Sweet Slumber, Tettlewort; Fr. Sanguinaire; Ger. Blutwurzel.

San-gui-na'ri-a. L. *sanguinarius* fr. *sanguis,* blood—*i. e.,* all of the plant-parts abound in, and when injured emit a blood-like juice.

Can-a-den'sis. L. Canadian, belonging to Canada—*i. e.,* habitat, where it is abundant.

PLANT.—Perennial herb putting forth in spring a rounded palmate, 5–9-lobed leaf and a slender scape 10–20 Cm. (4–8′) high, bearing large, single, white flower; leaves 7.5 Cm. (3′) long, 10–12.5 Cm. (4–5′) broad, palmately 5–9-lobed, lobes cleft at apex, light green, glaucous beneath, whitish, veins 5–9, reddish; sepals 2, fugacious; petals 8–12, white; fruit, June, capsule (pod), oblong, many-seeded. RHIZOME, of horizontal growth, occasionally branched, subcylindrical, flattened, 2–7 Cm. ($\frac{4}{5}$–3′) long, 5–15 Mm. ($\frac{1}{5}$–$\frac{3}{5}$′) thick, dark brown, slightly annulate, few stem-scars above, many broken filiform roots and root-scars beneath; fracture short, somewhat waxy, brownish-red, yellowish-white, numerous small, circular, yellowish fibro-vascular bundles within 1 Mm. ($\frac{1}{25}$′) of the epidermis; pith vary large, odor slight; taste persistently acrid and bitter. POWDER, brownish-red, sternutatory; microscopically—many starch grains resembling those of wheat, .003–.02 Mm. ($\frac{1}{8325}$–$\frac{1}{1250}$′) broad, also fragments of short latex cells with reddish-brown resinous masses; few tracheal fragments. *Solvents:* alcohol; diluted acetic acid; water. Dose, expectorant, gr. 1–8 (.06–.5 Gm.); emetic, gr. 15–30 (1–2 Gm.).

Commercial. — Plant growing in the North and South has marked distinctions, but everywhere is one of the earliest harbingers of spring, producing a pretentious white flower at first enfolded in, but expanding and perishing long before the leaf fully develops; all parts exude an orange sap, of deepest color in the rhizome, which deteriorates rapidly with age.

CONSTITUENTS. — Chelerythrine, Sanguinarine, Protopine (fumarine), β-Homochelidonine, resin, starch, citric and malic acids, ash 8 p. c.

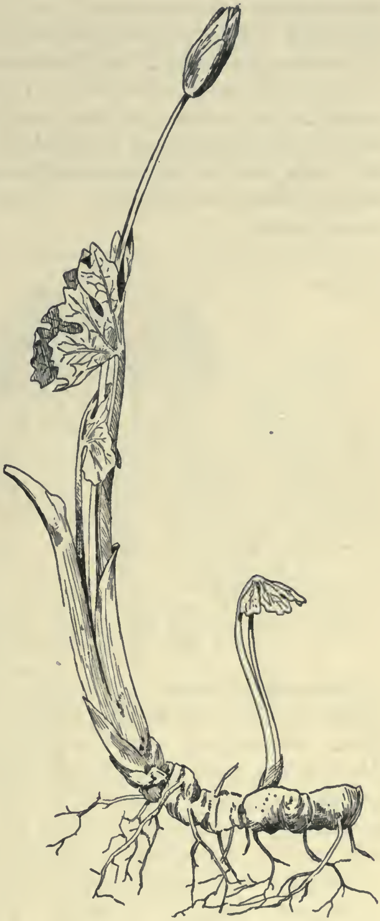


FIG. 148.—*Sanguinaria canadensis.*

Chelerythrine, $(C_{21}H_{17}NO_4)_2 \cdot H_2O + C_6H_5CH_3$, and **Sanguinarine**, $C_{20}H_{15}NO_4 + \frac{1}{2}C_2H_5OH$. —Obtained by exhausting the rhizome with 2 p. c. acetic acid menstruum, adding ammonia water in excess, thereby precipitating chelerythrine, sanguinarine, protopine, resin, and coloring matter, leaving in filtrate homochelidonine. This precipitate, when purified, is a yellowish-brown, sternutatory powder, having a variable solubility in alkaloidal solvents (alcohol, chloroform, acetone, ether, benzol); alcoholic solutions—reddish-brown; chloroform and acetone solutions—yellowish; ether and benzol—nearly colorless, giving a blue fluorescence. Exhaust powder with ether, evaporate; the light brown residue boiled with alcohol changes into a white crystalline powder, which, dissolved in chloroform and mixed with an equal quantity of alcohol, gives by spontaneous evaporation in a few days fine colorless crystals, melting at 263° C. (505° F.) (chelerythrine), separating out among a mass of reddish crystals, melting at 211° C. (412° F.) (sanguinarine); both alkaloids are purified, when chelerythrine occurs in greater amount, and in colorless crystalline crusts, yielding yellow salts with acids, while sanguinarine is in much the less quantity, in fine needles, yielding intensely red salts. Dose (sanguinarine), expectorant, gr. $\frac{1}{12}$–$\frac{1}{8}$ (.005–.008 Gm.); emetic, gr. $\frac{1}{4}$–$\frac{1}{2}$ (.015–.03 Gm.); properties similar to the drug.

Protopine, $C_{29}H_{19}NO_5$.—Obtained by treating impure sanguinarine with chloroform-alcohol, when it crystallizes out either as hemispherical wart-like aggregates of fine needles, or as well-developed colorless prisms; or free original filtrate from resin, add ammonia water, shake out with chloroform, evaporate, dissolve amorphous residue in hot acetic ether; melts at 206° C. (403° F.); with sulphuric acid—deep purple color.

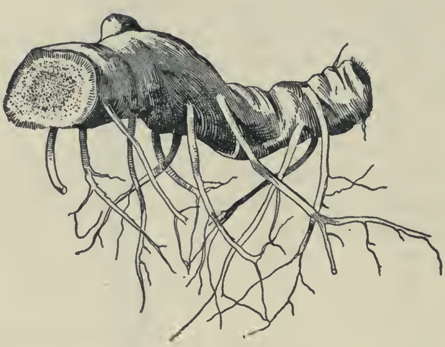


Fig. 149.—Sanguinaria rhizome, showing cross-section.

Homochelidonine, $C_{21}H_{23}NO_5$.—Obtained by freeing the original filtrate from resin, adding ammonia water, shaking out with chloroform, evaporating, and dissolving amorphous residue in hot acetic ether, when upon cooling wart-like crystals (protopine) separate out, and also crystals which melt at 155° C.; 311° F. (β-homochelidonine); protopine is almost insoluble in acetic acid, while homochelidonine is very soluble, a property which renders the alkaloids easily separable.

Resin.—Yields protocatechuic acid.

Preparations.—1. *Tinctura Sanguinariæ.* Tincture of Sanguinaria. (Syn., Tr. Sanguin., Tincture of Bloodroot; Fr. Teinture de Sanguinaire; Ger. Blutwurzeltinktur.)

Manufacture: 10 p. c. Menstruum 60 p. c. alcohol—moisten sanguinaria 10 Gm. with 3 Ml. (Cc.) of menstruum to which has been added hydrochloric acid 1 Ml. (Cc.), transfer to percolator without pressing, macerate, well-covered, for 6 hours, pack firmly, add menstruum, macerate for 24 hours, continue with menstruum q. s. 100 Ml. (Cc.). Dose, ♏v–60;—ʒj–2 (.3–4;—4–8 Ml. (Cc.)).

Unoff. Preps.: Acetum, 10 p. c., dose, ♏x-30;—ʒj-4 (.6-2;—4-15 Ml. (Cc.)). *Fluidextract* (citric acid 10, alcohol 75, water 25), dose, ♏j-5;—10-30 (.06-.3;—.6-2 Ml. (Cc.)). *Infusion*, 5 p. c., dose, ℥ss-4 (15-120 Ml. (Cc.)). *Syrup*, 22.5 p. c.

Properties.—Systemic emetic, stimulating expectorant (increasing broncho-pulmonary mucus), tonic, alterative, sialagogue, sternutatory, emmenagogue, cardiac paralyzer, violent irritant, acro-narcotic poison. Small doses excite the stomach, increase the circulation, while large doses nauseate and depress the pulse; full doses vomit actively; when inhaled causes violent sneezing.

Uses.—Bronchitis, croup, asthma, pneumonia, chronic nasal catarrh (tincture ♏x; .6 Ml. (Cc.) at a dose), atonic dyspepsia with torpid liver, jaundice, duodenal catarrh, amenorrhœa, syphilis. Externally the powdered drug or juice to ulcers, warts, scaly and pustular eruptions, nasal polypi.

Poisoning: Have violent emesis, salivation, catharsis, burning in stomach, thirst, faintness, vertigo, dim vision, dilated pupils, reduced temperature, cold sweats, slow, weak, irregular pulse, great prostration, death from paralysis of heart and respiratory centres, often preceded by convulsions. Wash out the stomach, give diffusible stimulants freely, amyl nitrite; morphine and atropine to antagonize depression of circulation and local irritation (pain and nausea).

Allied Plants:

1. *Chelido'nium ma'jus, Chelidonium, Celandine.* — The entire plant, collected when beginning to flower, official 1880-1900; Europe, N. America. Perennial light green plant, .6 M. (2°) high, emitting when wounded a saffron-yellow, opaque juice; leaves pinnate, 10-20 Cm. (4-8′) long; flowers yellowish; root reddish-brown, several-headed, branching; fruit capsule, linear, 2-valved; seed numerous; odor unpleasant when fresh; taste acrid; contains chelerythrine, chelidonine, α- and β-homochelidonine, chelidoxanthin, sanguinarine, protopine, chelidonic (jervic) acid, chelidoninic (ethylenesuccinic) acid, gum, chlorophyll; solvents: water, alcohol. Cathartic, diuretic, diaphoretic, expectorant; used by ancients as now for jaundice, dropsy, intermittent fever, scrofula, skin diseases; externally—warts, corns, eczema, urticaria, itching eruptions; fresh herb in amenorrhœa, as a vulnerary. Dose, dried plant, gr. 15-60 (1-4 Gm.); fresh plant, ʒj-2 (4-8 Gm.); extract, gr. 10 (.6 Gm.); fluidextract, ʒss-1 (2-4 Ml. (Cc.)); infusion, 5 p. c., ℥j-2 (30-60 Ml. (Cc.)); expressed juice (fresh plant), ♏x-20 (.6-1.3 Ml. (Cc.)).

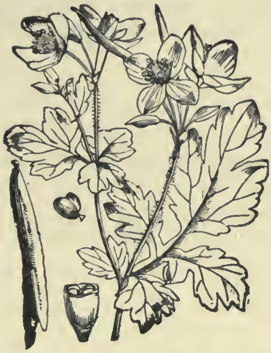


Fig. 150.—*Chelidonium majus:* showing fruit, flowers, ovary, and seed.

2. *Glau'cium Glaucium (lu'teum), Yellow Horned Poppy,* and *G. cornicula'tum.*—Both are similar to chelidonium; contain yellow juice and nearly identical alkaloids, hence used for about the same purposes.

3. *Bicucul'la (Dicen'tra) canaden'sis, Corydalis, Squirrel Corn;* Canada to Ky. Small perennial; tubers often in 3's, 6–10 Mm. ($\frac{1}{4}$–$\frac{2}{5}$′) thick, yellowish, horny, bitter; corydaline, fumaric acid, bitter extractive, resin, starch. Tonic, diuretic, alterative; syphilitic, scrofulous and cutaneous affections. Dose, gr. 10–30 (.6–2 Gm.); fluidextract (75 p. c. alcohol); comp. elixir, 6 p. c., +.

29. CRUCIFERÆ. Mustard Family.

Kru-sif'e-re. L. *Crucifer,* fem. pl. fr. *cru(x)c,* a cross, + *ferre,* to bear—*i. e.,* flowers (petals) arranged in shape of maltese cross. Herbs, shrubs. Distinguished by pungency or acrid juice, cruciform flowers, tetradynamous stamens, fruit a silique or silicle, 2-celled; sepals 4; petals 4; stamens 6, of which 2 are shorter and inserted lower down; pistil 1, compound, superior; seeds albuminous; temperate, frigid, and tropical climates; antiscorbutic, pungent, acrid (fixed and volatile oils).

Genera: **1. Sinapis. 2. Brassica.**

SINAPIS. MUSTARD.

1. SINAPIS ALBA. White Mustard.
2. SINAPIS NIGRA. Black Mustard.

1. Sinapis alba, *Linné.*
2. Brassica nigra, (*Linné*) *Koch.*
The ripe seeds, with not more than 5 p. c. of other seeds, foreign matter.

Habitat. Asia, S. Europe, cultivated in gardens; wild in United States.

Syn. 1. Sinap. Alb., Yellow Mustard, Charlock, Kedlock; Sinapis Albæ Semina; Fr. Moutarde blanche; Ger. Semen Erucæ, Weisser Senfsamen. 2. Sinap. Nig., Brown Mustard, Cadlock, Kerlock; Sinapis Nigræ Semina; Fr. Moutarde noire (grise); Ger. Semen Sinapis, Schwarzer Senf, Senfsamen.

Si-na'pis. L. fr. Gr. (σί)ναπι, Celtic *nap,* a turnip.

Bras'si-ca. L. for cabbage, fr. Celtic *bresic,* cabbage—*i. e.,* the fruit resemblance.

Al'ba. L. *albus,* white—*i. e.,* the seed.

Ni'gra. L. *niger,* black—*i. e.,* the seed.

Mus'tard. L. *mustum,* must—*i. e.,* seeds were once pounded with must or vinegar.

PLANTS.—*Sinapis alba,* erect annual, .6 M. (2°) high, branches few, ascending, stiff, green, bristly, with reflexed hairs; leaves stalked, pinnatifid, hairy, 3–lobed, dentate; flowers June, yellow, racemes; fruit silique, 2.5–4 Cm. (1–1$\frac{3}{5}$′) long, 5 Mm. ($\frac{1}{5}$′) broad, constricted, terete, bristly, beak long, sword-shaped, 4–6-seeded, dehiscing by 2 valves; roots fusiform, thin, branching; *Brassica nigra,* similar to preceding, except higher, 1.3 M. (4°), smooth above, leaves irregularly pinnatifid, faintly toothed, flowers half as large, 6 Mm. ($\frac{1}{4}$′) broad; fruit 18 Mm. ($\frac{3}{4}$′) long, 1 Mm. ($\frac{1}{25}$′) broad, appressed, somewhat quadrangular, beak short, tapering, 3–7-seeded. SEEDS (*S. alba*), subglobular, 1.5–2.5 Mm. ($\frac{1}{16}$–$\frac{1}{10}$′) broad; testa yellowish, nearly smooth; embryo yellowish, oily, 2 large cotyledons; inodorous; taste mildly pungent, acrid; (*B. nigra*), ellipsoidal, irregularly spheroidal, 1–1.6 Mm. ($\frac{1}{25}$–$\frac{1}{16}$′) broad; testa reddish-brown, minutely pitted (reticulate); embryo yellow, oily, 2 large cotyledons; odor slight (dry), on moistening very irritating; taste strongly pungent, acrid. Powder, yellowish, brownish, greenish-brown, slight odor on moistening, or strongly pungent, irritating, characteristic odor (*B. nigra*); microscopically—numerous tissues of embryo, the cells containing small aleurone grains and fixed oil, the latter forming in large globules on adding hydrated chloral T. S.; fragments of seed-coat few or conspicuous, with characteristic stone cells, epidermal cells with mucilaginous walls; few or no starch grains. *Test:* 1. Distil with steam—allyl isothiocynate with *black*, but none with *white mustard.* Should be kept, when powdered, in tightly-closed containers. *Solvents:* water; alcohol slightly. Dose, gr. 15–60 (1–4 Gm.).

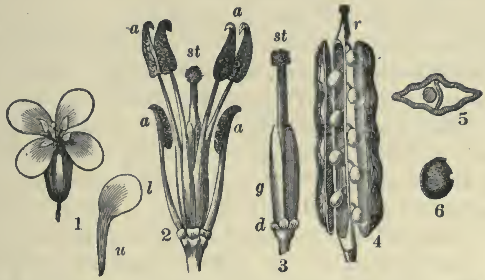


Fig. 151.—*Brassica nigra: 1,* flower; *2,* pistil and stamens; *3,* pistil; *4,* silique; *5,* cross-section of same; *6,* seed; *a,* stamen; *st,* stigma; *g,* pistil carpels; *d,* nectar tubes; *r,* replum.

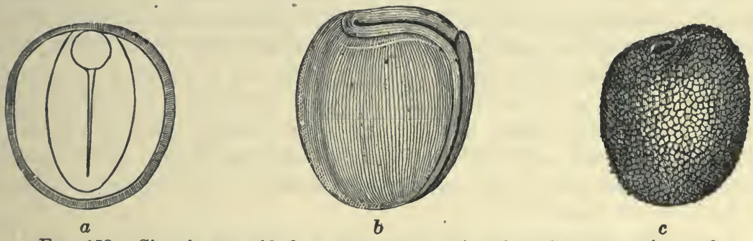


Fig. 152.—Sinapis, magnified: *a,* transverse section; *b,* embryo; *c,* entire seed.

Adulterations.—Seeds (*white* and *black*)*:* Those of allied species—radish, turnip, rape, the latter most common, but easily recognized by larger size and peculiar bluish-red tint; Powder: Flour, starchy substances (blue with iodine), turmeric—rendering white mustard whiter (reddish-brown with borax or boric acid), red pepper (increasing pungency), sawdust (microscope); out of 27 samples examined only 8 were free of admixtures; white mustard recognized by not giving pungent fumes when mixed with water unless heated; Oil:

Alcohol, carbon disulphide, castor oil, petroleum, artificial allyl isosulphocyanate, etc.

Commercial.—Plants are cultivated largely in England, United States, etc., and grow wild—the *white* occasionally, the *black* commonly. The seeds of each on grinding and sifting yield a yellow powder of characteristic odor and taste, and by mixing equal quantities of the two is obtained *mustard, flour of mustard* (Sinapis, Br.), which by trituration with water (vinegar) and spices yields the semi-solid *French mustard.*

CONSTITUENTS.—WHITE MUSTARD: Fixed oil 20–25 p. c., Sinalbin, Sinapine sulphocyanide, lecithin, albumin 28 p. c., gum and mucilage 19 p. c. (mainly in testa), myrosin, other proteids, starch, 1–2.5 p. c., ash 4–9 p. c. BLACK MUSTARD: Fixed oil 30–35 p. c., Sinigrin (potassium myronate) .7–1.3 p. c., Sinapine sulphocyanide, lecithin, albumin 30 p. c., gum and mucilage 20 p. c. (mainly in testa), myrosin, other proteids, starch 1–2.5 p. c., ash 4–9 p. c.

Fixed Oil.—Obtained by crushing seeds and expressing; it is yellowish-green, non-drying, sp. gr. 0.916, congeals —18° C. (0° F.), slight odor, bland, mild taste; consists of glycerides of oleic, stearic, erucic, and behenic acids.

Sinapine.—Alkaloid, here only as sulphocyanide, in colorless, bitter prisms, soluble in water, alcohol. Sinapine boiled with alkalies gives choline or sinkaline, $C_5H_{15}NO_2$, and sinapic acid, $C_{11}H_{12}O_5$.

Myrosin.—This ferment is an albuminoid body that becomes inert at 70° C. (158° F.), hence mustard heated to this point will not yield the volatile oil, owing to which the plasters should not be moistened with water warmer than the body temperature.

Sinalbin.—$C_{30}H_{44}N_2S_2O_{16}$.—Extracted by alcohol; it is in colorless prisms, soluble in water, sparingly in alcohol, yellow by alkali, red with nitric acid; in the presence of water the ferment myrosin acts upon it, yielding glucose, $C_6H_{12}O_6$, sinapine sulphate, $C_{16}H_{23}NO_5.H_2SO_4$, and acrinyl sulphocyanide, $C_7H_7O.NCS$ (yellow, acrid, non-volatile oil), soluble in alcohol, ether.

Sinigrin, $KC_{10}H_{18}NS_2O_{10}$.—Silky, white needles, or golden-yellow crystals, soluble in water, slightly in alcohol, insoluble in ether, chloroform; with water and the ferment myrosin it splits into glucose, acid potassium sulphate, and allyl sulphocyanide (isosulphocyanate—volatile oil of mustard) .5–1 p. c.

Oleum Sinapis Volatile. Volatile Oil of Mustard, *official.*—(Syn., Ol. Sinap. Vol., Mustard Oil, Oleum Sinapis Æthereum, Oil of Mustard; Fr. Essence de Moutarde; Oleum Sinapis, Senföl, Ætherisches Senföl.) This oil, like oil of bitter almond and to a great extent oil of gaultheria, does not preëxist in the plant, being obtained by macerating with warm water the crushed black mustard seeds (*B. nigra* or *B. juncea*), after the removal of fixed oil by expression, when a reaction (fermentation) sets in between sinigrin (potassium myronate) and myrosin (albuminoid ferment), provided the temperature does not exceed 70° C. (158° F.), at which the ferment becomes inert and ceases to act—

$KC_{10}H_{16}NS_2O_9$ (sinigrin) + H_2O = C_3H_5NCS (volatile oil of mustard) + $C_6H_{12}O_6$ (dextrose) + $KHSO_4$; also have formed allyl cyanide, carbon disulphide, allyl thiocyanate, and higher boiling compounds, which are always in the oil; when fermentation is completed the mixture is distilled with steam; this oil also is produced to a large extent synthetically by decomposing allyl iodide, C_3H_5O, with potassium sulphocyanate in alcoholic solution. It is a colorless, pale yellow, strongly refractive liquid, very pungent, irritating odor, acrid taste (in both exercise great caution, examining it only when highly diluted), optically inactive, sp. gr. 1.020, soluble in alcohol, volatile at 150° C. (302° F.); contains at least 92 p. c. of allyl isothiocyanate (isosulphocyanate), with traces of allyl cyanide, carbon disulphide, etc. *Tests:* 1. Distils completely between 148–154° C. (298–310° F.), first and last portions having nearly the same sp. gr. as original oil (abs. of alcohol, chloroform, petroleum, fatty oils). 2. Dilute oil with alcohol (2–3 vols.) + a drop of ferric chloride T. S.—no blue color (abs. of phenols). The label must indicate definitely its specific source, whether from black mustard or made synthetically. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏ $\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 Ml. (Cc.)).

PREPARATIONS.—BLACK MUSTARD: 1. *Emplastrum Sinapis.* Mustard Plaster. (Syn., Emp. Sinap., Charta Sinapis, U. S. P. 1900, Mustard Paper; Fr. Papier moutarde (sinapisé), Moutarde en feuilles; Ger. Charta sinapisata, Senf papier.)

Manufacture: Percolate black mustard 100 Gm. with petroleum benzin until percolate gives no greasy stain on blotting paper, dry the powder; dissolve rubber 10 Gm. in petroleum benzin and carbon disulphide each 100 Ml. (Cc.), and with this mix the purified mustard to produce a semi-liquid magma, spread on paper, cotton cloth, or other fabric; it is a uniform mixture of black mustard, deprived of its fixed oil, and a solution of rubber; 100□Cm. contain 2.5 Gm. of black mustard deprived of its fixed oil. Before applying to the skin moisten thoroughly with tepid water, when it will produce a decided warmth and redness within 5 minutes. Should be kept in tightly-closed containers.

Unoff. Preps.: SEED: *Infusion,* 5 p. c., dose, *ad libitum.* OIL: *Compound Liniment,* 3 p. c., + mezereum (fldext.) 20, camphor 6, castor oil 15, alcohol q. s. *Linimentum Sinapis* (Br.), 3.5 p. c. *Spiritus Sinapis* (Ger.), 2 p. c.

PROPERTIES.—Stimulant, emetic, tonic, diuretic, laxative, rubefacient, irritant, epispastic, carminative, condiment, vesicant; dilates the vessels, causing redness, warmth, and irritates sensory nerves, giving burning pain.

USES.—Atonic dyspepsia with constipation, delirium tremens, atonic dropsy, hiccough, narcotic poisoning. Externally—rheumatism, gout, atrophy, neuralgia, colic, gastralgia, inflammation of throat or lungs, toothache, earache, headache, vomiting, diarrhœa, dysentery, amenorrhœa, dysmenorrhœa, stimulant to heart, respiration, and vascular system.

For mild action: Dilute mustard with equal quantity of flaxseed meal or flour, and make with water into a pasty plaster—poultice, cataplasm, or sinapism; should be applied enveloped in very thin muslin to prevent sticking, and is superseded almost entirely by the whole- and half-strength *mustard leaves,* which, in order to use, should be dipped into warm water for 15 seconds and applied for $\frac{1}{2}$–1 hour. The volatile oil may be used locally, well diluted (ʒss; 2 Ml. (Cc.)) + Stokes' liniment, alcohol, or almond oil ℥ij; 60 Ml. (Cc.)). Good in scabies, hysteria, swooning convulsions.

Mustard foot-baths, valuable in headache, cerebral and other internal congestion, pneumonia, amenorrhœa, for diaphoresis.

The infusion, made by stirring a tablespoonful to a cream with warm water, is a popular emetic in poisoning, etc., giving the entire mixture.

Allied Plants:

1. *Brassica jun'cea, Sarepta, Indian, Russian Mustard.*—S. Russia, Africa, India, from this latter country exported into Europe; seed closely resemble the official black mustard, and have the same constituents. *B. arven'sis* (*Sinapis'trum*), *Charlock, Wild Mustard,* Europe, United States; an annual, troublesome weed; seed smoothish, dark brown, smaller and less pungent than our official black mustard. *B. olera'cea, Cabbage,* Europe; leaves large, smooth, glaucous, very different from cultivated varieties. *B. campes'tris;* Europe, Russian Asia. Wild annual, .3–.6 M. (1–2°) high, flowers bright yellow; of this we have several cultivated varieties which give edible roots and seeds of some value, thus: (*a*) var. *Na'pus, Turnip*—seed larger than official black mustard, 1.6–2 Mm. ($\frac{1}{16}$–$\frac{1}{12}$′) thick, brown or black, finely pitted, slightly acrid; (*b*) var. *Ra'pa, Rape, Colza*—seed larger than mustard or turnip, 2–2.5 Mm. ($\frac{1}{12}$–$\frac{1}{10}$′) thick, finely pitted, blue-black, slightly acrid; both yield a bland, yellow fixed oil under the names of turnip-seed oil and rapeseed oil; (*c*) var. *Rutaba'ga, Swedish Turnip*—seed also small and contain oil and pungency.

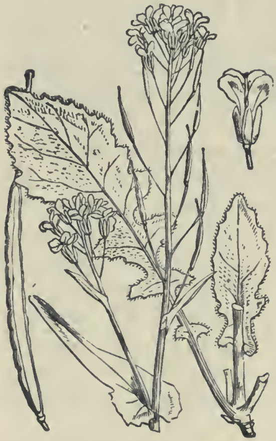


FIG. 153.—*Brassica campestris.*

2. *Armoraciæ Radix, Horseradish Root* (Br.).—The fresh root of *Rori'pa* (*Cochlea'ria*) *Armora'cia,* official 1820–1860; E. Europe, cultivated. Plant .6–1 M. (2–3°) high, in moist places; leaves 20–30 Cm. (8–12′) long, 10–12.5 Cm. (4–5′) wide, toothed; flowers white; fruit 2-celled pod, each 4–6-seeded; root 30 Cm. (12′) long, 12–25 Mm. ($\frac{1}{2}$–1′) thick, conical, yellowish, scaly, warty, inside white, many stone cells, central pith, pungent odor when bruised; taste sharp, acrid; contains volatile oil .05 p. c. (isomeric with mustard oil, C_3H_5NCS),

resin. Used as condiment, rubefacient, stimulant, diuretic, for dyspepsia, rheumatism, dropsy, palsy, scurvy, hoarseness, vomiting; in infusion, spirit (Spiritus Armoraciæ Compositus (Br.), 12.5 p. c.), cataplasm. Dose, gr. 20–30 (1.3–2 Gm.); spirit, ʒj–2 (4–8 Ml. (Cc.)).

3. *Raph'anus Raphanis'trum, Wild Radish, Jointed Charlock,* and *R. sati'vus, Garden Radish.*—Both contain a fixed oil resembling that from mustard, but the sulphuretted volatile oil of the latter differs in some respects. *Dro'sera rotundifo'lia,* +, *Sundew;* air-dried flowering plant; bronchitis, etc. Dose, ʒss–1 (2–4 Gm.); fluidextract (67 p. c. alcohol).

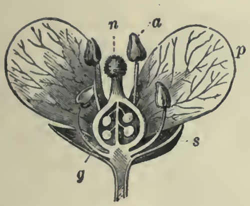


FIG. 154.—*Roripa Armoracia:* flower: *s*, calyx; *p*, corolla; *a*, stamen; *g*, fruit carpel; *n*, stigma.

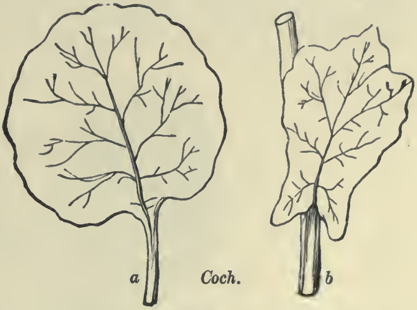


FIG. 155.—*Roripa Armoracia:* leaves: *a*, radical; *b*, cauline.

30. HAMAMELIDACEÆ. Witch Hazel Family.

Ham-a-me-li-da'se-e. L. *Hamamel(is)-id* + aceæ, fr. Gr. ἅμα, together with, + μηλόν, fruit (apple)—*i. e.*, flowers and fruit together on the tree. Shrubs, trees. Distinguished by fragrant balsamic properties; ovary inferior, 2-celled, consisting of 2 pistils united below, forming 2-beaked, 2-celled, woody capsule; ovules 1 in each cell, pendent from cell apex, becoming bony seed; stamens 8, 4 perfect, 4 scale-like, sterile; flowers, heads or spikes, sometimes apetalous; calyx and petals 4–5; temperate climates, tropics; bitter, astringent, acrid, balsamic.

Genera: **1. Hamamelis. 2. Liquidambar.**

HAMAMELIS. HAMAMELIS.

Aqua Hamamelidis. Hamamelis Water, official.

Hamamelis virginiana, *Linné.* — A saturated aqueous liquid distilled with steam or water from the bark, twigs, smaller stems, or entire shrub, collected in autumn.

Habitat. N. America, in thickets, ditch banks; Canada, United States, Minn. to La.

Syn. Hamamelis (leaves), Witch Hazel, Wych-hazel, Winter Bloom, Striped (Spotted) Alder, Snapping Hazel Nut, Tobacco Wood; Aq. Hamam., Witch Hazel Water, Distilled Extract of Witch Hazel; Br. Liquor Hamamelidis, Solution of Hamamelis; Fr. Hamamélis de Virginie; Eau de Hamamelidis; Ger. Zauberhasel; Hamamelidiswasser.

Ham-a-me'lis. L. see etymology, page 255, of Hamamelidaceæ.
Vir-gin-i-a'na. L. Virginian, of or belonging to Virginia—*i. e.*, its original habitat.
Witch-ha'zel. Witch from twigs being used in days of witchcraft as divining rods to indicate hidden springs, ores, etc., + *hazel*, resembling hazel tree.

Plant.—Woody shrub 1.5–4.5 M. (5–15°) high, 7.5–15 Cm. (3–6′) thick; stem crooked; leaves short, petiolate, inequilaterally obovate, 10 Cm. (4′) long, 6 Cm. ($2\frac{1}{2}$′) broad, base slightly cordate and obliquely coarsely sinuate, pale or brownish-green, under surface lighter green, with satiny lustre, midrib and veins prominent, the few hairs with thick walls and small lumen; fruit (nut or capsule) 2-celled, 2-beaked with 1 bony, oily, edible black seed in each cell, ripening in September of the following year when new flowers are blooming, hence generic name, and when ripe bursting elastically by hygroscopism into 2 segments, hurling the seed with considerable force to a distance. Bark and twigs, in irregularly quilled, bent pieces, 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, grayish-brown, many lenticels, or reddish-brown, with short transverse ridges or scars, or somewhat scaly in old bark, thin corky layer easily removed from pale cinnamon-color middle bark, inner surface pale cinnamon, yellowish, smooth, finely striate, fracture short (young) or tough (old) in the bast layer; odor slight; taste astringent, bitter, pungent. *Solvents:* boiling water; diluted alcohol. Dose, ʒss–1 (2–4 Gm.).

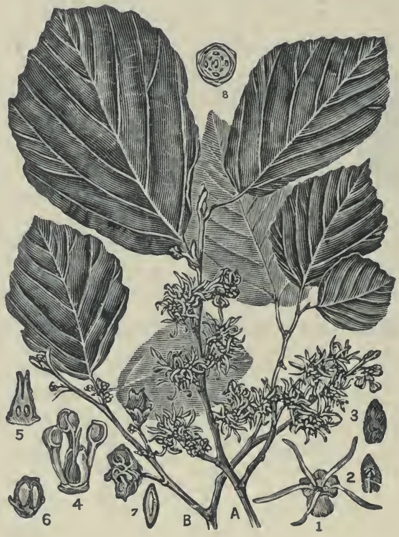


Fig. 156.—*Hamamelis virginiana: A*, flowering twig; *B*, fruit-bearing twig; *1*, flower, magnified; *2*, sepal and stamen; *3*, sepal, outer surface; *4*, essential organs; *5*, pistil; *6*, fruit; *7*, seed (four last longitudinal sections); *8*, floral diagram.

Constituents.—Tannin, volatile oil, bitter principle, extractive.

Preparations.—1. *Aqua Hamamelidis.* Hamamelis Water.

Manufacture: Distil bark, twigs, smaller stems or entire shrub collected in autumn 1,000 Gm. with steam or water 2,000 Ml. (Cc.), reserve first 850 Ml. (Cc.) of distillate, add alcohol 150 Ml. (Cc.). It is a saturated aqueous liquid, clear, colorless, faintly opalescent, slightly yellow, characteristic odor and taste; neutral, faintly acid; sp. gr. 0.980. *Tests:* 1. Must be free from mucoid or fungous growths and acetous odor; no reaction with hydrogen sulphide T. S. or sodium sulphide T. S. (abs. of metals); evaporate 100 Ml. (Cc.)—residue .025 Gm. 2. Must contain not less than 14 p. c. of alcohol. *Impurities:* Metallic and dissolved substances, formaldehyde, methyl alcohol. Dose, ʒj–4 (4–15 Ml. (Cc.)); mostly externally.

Unoff. Preps.: (Leaves, Bark, Twigs) *Decoction,* 5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)). *Extract,* dose, gr. 5–10 (.3–.6 Gm.). *Fluidextract* (alcohol 30, water 60, glycerin 10), dose, ♏xv–60 (1–4 Ml. (Cc.)). *Tinctura Hamamelidis* (Br.), 10 p. c., dose, ʒss–1 (2–4 Ml. (Cc.)). *Unguentum Hamamelidis* (Br.), 10 p. c. of liquid extract.

Properties.—Astringent, hæmostatic, styptic, sedative, tonic. Acts on the muscular fibres of the veins; large doses produce severe throbbing headache.

Uses.—It was used first by the North American Indians for external inflammations, congestions, and now for same purposes, as also for hemorrhages of nose, gums, piles, bladder, stomach, rectum, tumors, hemorrhoids, varicose veins, diarrhœa, dysentery.

The Pond's Extract and Distilled Extract (Aqua Hamamelidis (Spirituosa)) are approximately identical, both being colorless, and employed indiscriminately as external applications for sprains, bruises, excoriations, pharyngitis, rhinitis, leucorrhœa, gonorrhœa, ulcers, skin diseases, etc.

STYRAX. STORAX.

Liquidambar orientalis, { A balsam obtained from the wood and inner bark.
Miller.

Habitat. Asia Minor—Southwestern portion, near coast, forming entire forests.

Syn. Liquid Storax, Oriental Sweet Gum, Lordwood; Br. Styrax Præparatus, Prepared Storax, Balsamum Styracis; Fr. Styrax liquide (purifie, depuratus); Ger. Styrax depuratus, Gereinigter Storax.

Liq-uid-am'bar. L. *liquidus,* liquid, fluid, + Ar. *ambar,* amber—*i. e.,* the color or fragrant, terebinthinate juice or resin (balsam) resembles liquid amber.

O-ri-en-ta'lis. L. oriental, pertaining to the Orient, or East—*i. e.,* its habitat.

Sty'rax. L. for storax, Gr. *στύραξ,* altr. of Ar. *assthi'rak,* sweet-smelling exudation—*i. e.,* a tree producing it.

Plant.—Tree 6–15 M. (20–50°) high, resembling our sweet-gum; bark purplish-gray; leaves palmately 5-divided, each division obscurely 3-lobed, 5–7.5 Cm. (2–3′) long, 10–12.5 Cm. (4–5′) wide, margin serrate, bright green, smooth; flowers monœcious, in yellowish solitary heads; fruit, globular capsule, 2.5 Cm. (1′) broad, woody. Balsam (storax), a semi-liquid, grayish, sticky, opaque mass, depositing on standing a heavy, dark brown stratum; transparent in thin layers; characteristic odor, acrid taste; heavier than water and insoluble in it, but soluble (except accidental impurities) in warm alcohol (1), also in ether, acetone, benzene, carbon disulphide. *Tests:* 1. When heated—more fluid; now agitate with warm, purified petroleum benzin, decant and cool supernatant liquid—only pale yellow, and deposits white crystals of cinnamic acid and cinnamic esters, which heated with diluted sulphuric acid and potassium permanganate—odor of benzaldehyde; incinerate .5 Gm.—ash 1 p. c. 2. Dissolve 10 Gm. in hot alcohol 20 Ml. (Cc.)—undissolved residue 2.5 p. c.; evaporate filtrate—brown, transparent, semi-liquid residue 60 p. c., mostly soluble in ether, only partially soluble in purified petroleum benzin. *Solvents:* alcohol; ether. Dose, gr. 10–30 (.6–2 Gm.).

ADULTERATIONS.—Turpentine, sand, ashes, bark, mineral matter 13–18 p. c., water 10–40 p. c.

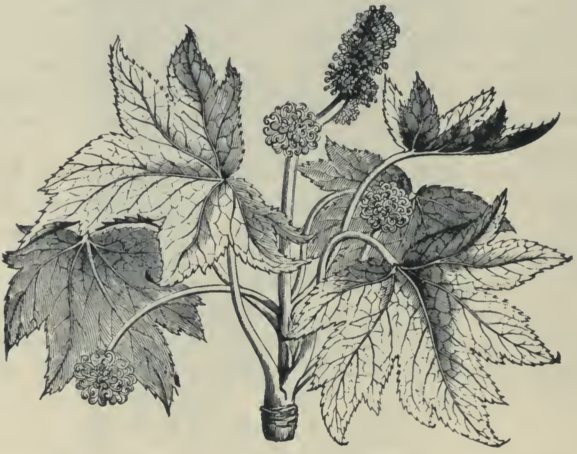


FIG. 157.—*Liquidambar orientalis.*

Commercial.—The balsam is not a physiological, but a pathological, secretion of the sapwood, existing only in injured trees as a result of wound stimulation—nature's method of securing antisepsis and healing. To obtain storax in quantity the outer bark on one side of the tree is bruised, resulting shortly thereafter in filling the cambium with rows of balsam glands and the inner bark with their exudation. The dead outer bark is taken off and rejected, while the inner is removed and boiled in sea-water—the balsam being skimmed from the surface with final expression of the boiled bark. It was once believed to be produced in the inner bark, which was collected and thrown into pits, to allow partial exudation, and ultimately subjected to pressure in strong horse-hair bags. Liquid storax is then put into barrels, goat skins, etc., and forwarded to Constantinople, Smyrna, Syria, Alexandria, Bombay, and Trieste. The greatest demand comes from India and China, the English-speaking people using little of it. The residual bark when dried (Cortex Thymiamatis) is employed for fumigation.

CONSTITUENTS.—A variable mixture chiefly of volatile oil, resins, cinnamic acid, esters, and water—Styrol, Styracin, Phenylpropyl Cinnamate, Storesin, Cinnamic Acid, 5–15 p. c., benzoic acid, ethyl cinnamate, $C_9H_7(C_2H_5)O_2$, ethyl vanillin, water 10–40 p. c., other impurities, ash 1 p. c.

Styrol, Styrene, Styrolene (*cinnamene, phenyl-ethylene*), C_8H_8.—Hydrocarbon (volatile oil) obtained by distilling with water; it is a colorless fragrant oily liquid, sp. gr. 0.906, boils at 145° C. (293° F.), and when heated to 200° C. (392° F.) is converted into solid metacinnamene.

Styracin, Cinnamyl Cinnamate, $C_9H_7(C_9H_9)O_2$.—This is obtained in faint yellow crystals by alcohol, ether, or hot benzene from the resin after removal of cinnamic acid; with concentrated potassium hydrate solution yields *styrone* (cinnamic alcohol), $C_9H_{10}O$, yellowish oily refractive aromatic liquid.

Phenylpropyl Cinnamate, $C_9H_7(C_9H_{17})O_2$.—This is a thick inodorous liquid.

Storesin, $C_{36}H_{58}O_3$.—This, the most abundant constituent, is amorphous, readily soluble in benzin, melts near 145° C. (293° F.), or near 165° C. (329° F.); the latter variety gives with potassium hydroxide a compound crystallizing in needles.

Cinnamic Acid, $C_9H_8O_2$.—Chiefly in free state, obtained by treating with solution of sodium carbonate, precipitating with hydrochloric acid.

PREPARATIONS.—1. *Tinctura Benzoini Composita,* 8 p. c.

Unoff. Prep.: Ointment (salve), 50 p. c., with lard or olive oil.

PROPERTIES.—Stimulant, expectorant, diuretic, antiseptic, disinfectant. Acts locally and remotely like benzoin, copaiba, balsams of tolu and Peru. Styracin is antiseptic, and should be dissolved in 6–12 parts of oil or water to render it non-irritating as a dressing.

USES.—Chronic bronchitis and catarrhs of genito-urinary passages, gonorrhœa, gleet, amenorrhœa, leucorrhœa, phthisis, asthma. Externally in ointment as a detergent for indolent ulcers, frost-bites, as a parasiticide for scabies, phthiriasis (pediculi), etc.

Allied Products:

1. *Styrax Calamita.*—Resinous exudation from *Styrax officina'lis,* in agglutinated tears resembling benzoin, wrapped in leaves; a factitious variety consists of the ground, exhausted bark or sawdust mixed with liquid storax, formed into reddish-brown cylindrical cakes, brittle, friable, soft and unctuous to the touch; contains many crystals of styracin, and has storax odor.

2. *Sweet Gum* (*Liquidambar Styraciflu'a*); United States.—The balsam exudes spontaneously in hot climates and warm weather, or from incisions made in the trunk; it is a yellowish-brown thick liquid, solidifying on exposure, but softening by heat of the hand, odor balsamic, storax-like; taste aromatic, pungent, soluble in alcohol, ether, chloroform; contains hydrocarbon 3.5 p. c. (almost identical with

styrol); cinnamic acid 5.5 p. c., styracin, storesin. Stimulant, expectorant, diuretic. Dose, gr. 5–30 (.3–2 Gm.); in emulsion; externally in ointment, cerate. Used mainly as an agreeable flavor and in making chewing gum.

3. *Heu'chera america'na, Alum Root.*—Saxifragaceæ. The rhizome, official 1820–1880; United States. Plant viscid, pubescent, .6–1.3 M. (2–4°) high; leaves 5–7.5 Cm. (2–3′) wide, crenate; flowers purplish-white; root 15 Cm. (6′) long, 12 Mm. (½′) thick, several-headed, many thin radicles, brownish-purple; bark thin, inodorous, astringent, bitter; contains tannin 18–20 p. c., starch 5–16 p. c. Used as astringent, tonic, in diarrhœa, menorrhagia, aphthæ, ulcers, hemorrhoids. Dose, gr. 15–30 (1–2 Gm.), in decoction. *Hydran'gea arbores'cens, Seven-barks;* dried rhizome and roots; diuretic, etc. Dose, gr. 15–30 (1–2 Gm.); fluidextract (75 p. c. alcohol).

31. ROSACEÆ. Rose Family.

Ro-za'se-e. L. *Ros'a* + aceæ, fem. pl. *rosace-us*, rose-like, fr. *rosa*, a rose. Trees, shrubs, herbs. Distinguished by astringency, succulent edible fruits, prickles and warts on woody surfaces; flowers regular, 5's; stamens inserted on calyx-tube, perigynous; calyx 4–5-lobed—when 5 the odd lobe posterior; anthers 2-celled; pistil 1–many, usually distinct; fruit often edible; seed exalbuminous. The yellow and white flowers resemble Ranunculaceæ, where, however, the stamens and pistils are inserted on the torus, but in Rosaceæ on the calyx; temperate climates; astringent, tonic, anthelmintic; fruit edible.

Genus: **1. Rosa.**

ROSA GALLICA. RED ROSE.

Rosa gallica, *Linné.* { The dried petals, collected just before the expansion of the flower.

Habitat. W. Asia, S. Europe; cultivated (England, Holland, France, United States, etc.).

Syn. Rosa Gall., French Rose, Provins Rose; Br. Rosæ Gallicæ Petala, Red Rose Petals, Flores Rosarum Rubrarum; Fr. Rose rouge—de Provins, Roses rouges; Ger Französische Rose, Essigrosen-(blätter), Zuckerrose.

Ro'sa. L. fr. Gr. *ῥόδον*, Eng. rose, fr. Celtic *rhos*, red—*i. e.*, the prevailing color of the flowers.

Gal'li-ca. L. *gallicus*, of or pertaining to Gaul, now France—*i. e.*, country where once it flourished extensively—French rose.

Plant.—Bushy shrub, .6–1 M. (2–3°) high, stems numerous, covered with prickles and a few sharp spines; leaves alternate, imparipinnate, 2 pairs opposite leaflets, these nearly sessile, ovate, rounded at base, acute at apex, serrate, stiff, keeled, rugose, with veins, pale, hairy below, leaf-serratures not edged with glands; flowers large, on long stalks, petals 5 in the wild state, more when cultivated, rich-crimson; fruit (hip) scarlet to orange-red, oblong, containing many 1-seeded achenes, calyx persistent. Petals, either separate or imbricated in small cones, broadly ovate, summit rounded, deeply notched, margin entire, somewhat recurved, base obtuse, purplish-red except the light brown claw; texture velvety; when dry brittle; odor agreeable; taste astringent, slightly bitter. Powder, reddish-brown; microscopically—epidermal cells with purplish-red content (sap), fragments of fibro-vascular bundles, spiral tracheæ, rectangular cells with purplish content (sap). *Solvents:* boiling water; diluted alcohol. Dose, gr. 15–60 (1–4 Gm.).

Commercial.—Plant, in its many species and varieties, very largely cultivated domestically as well as commercially; petals are obtained by circumcising with a sharp knife the unopened corolla-buds, leaving the stamens behind on the calyx; or the entire blooms are cut off with knives or scissors, dried carefully but rapidly by stove heat (in order to preserve astringency and color), sifted, if necessary, from stamens, etc., and marketed; early collection is more astringent and of better color, qualities impaired by slow drying. It is claimed that 1000 flower-buds yield 50 pounds (23 Kg.) of fresh petals, which when dried become 5 pounds (2.3 Kg.).

Adulterations.—Petals of various red roses.

Constituents.—Volatile oil (trace), mucilage, tannin (quercitannic acid?), gallic acid, quercitrin, quercetin (astringent and coloring), sugar, ash 3.5 p. c.

Preparations.—1. *Fluidextractum Rosæ.* Fluidextract of Rose. (Syn., Fldext. Rosæ, Fluid Extract of Rose; Fr. Extrait fluide de Rose rouge; Ger. Essigrosenfluidextrakt.)

Manufacture: Similar to Fluidextractum Ergotæ, page 60; 1st menstruum: alcohol 50 Ml. (Cc.), water 40, glycerin 10; 2nd menstruum: diluted alcohol. Dose, ♏xv–60 (1–4 Ml. (Cc.)).

Prep.: 1. *Mel Rosæ.* Honey of Rose. (Syn., Mellitum Rosatum; Fr. Mellite de Roses rouges, Miel Rosat; Ger. Mel rosatum, Rosenhonig.)

Manufacture: 12 p. c. Mix fluidextract of rose 12 Ml. (Cc.) with clarified honey q. s. 100 Gm. Dose, ʒj–2 (4–8 Ml. (Cc.)).

Prep.: 1. *Massa Hydrargyri* (33 p. c.)—32 p. c.

2. *Aqua Rosæ Fortior.* Stronger Rose Water. (Syn., Aq. Ros. Fort., Triple Rose Water, Aqua Rosæ; Fr. Eau distillée fort de Rose; Ger. Stärkeres Rosenwasser.)

Manufacture: The saturated aqueous distillate from fresh flowers of *Rosa centifolia.* It is colorless, clear, strong, pleasant odor and taste of fresh rose blossoms, free from empyreuma, mustiness, or mucoid growths; neutral, slightly acid; evaporate 100 Ml. (Cc.)—residue .001 Gm.; no reaction with hydrogen sulphide T. S., or sodium sulphide T. S. (abs. of metallic substances). Should be kept cool, dark, in bottles stoppered with a pledget of purified cotton. Dose, ʒij–8 (8–30 Ml. (Cc.)).

Preps.: 1. *Aqua Rosæ.* Rose Water. (Syn., Aq. Ros., Aqua Rosarum; Fr. Eau distillée de Rose; Ger. Rosenwasser.)

Manufacture: Mix, immediately before using, stronger rose water, and distilled water, recently boiled, each 1 volume. Dose, ʒij–8 (8–30 Ml. (Cc.)).

2. *Unguentum Aquæ Rosæ.* Ointment of Rose Water. (Syn., Ung. Aq. Ros., Cold Cream; Fr. Crême froide; Ger. Unguentum leniens—emolliens.)

Manufacture: Melt, in fine pieces, spermaceti 12.5 Gm., white wax 12 Gm., add expressed oil of almond 56 Gm., stir, heat until uniform; add gradually stronger rose water 19 Gm., previously warmed and having dissolved in it sodium borate .5 Gm., stir rapidly and continuously until congealed and uniform; must be free from rancidity, and if chilled should be warmed slightly before incorporating other ingredients.

Unoff. Preps.: Confection, 8 p. c. (red rose 8, sugar 64, clarified honey 12, stronger rose water, heated, 16), dose, ʒss–1 (2–4 Gm.). *Infusion,* 3–5 p. c. *Compound Infusion,* 1.5 p. c. (+ diluted sulphuric acid 1, sugar 4.5, water q. s.), dose, ℥ss–2 (15–60 Ml. (Cc.)). *Infusum Rosæ Acidum* (Br.), 2.5 p. c., + diluted sulphuric acid 1.25 p. c., water q. s. *Syrup,* 12.5 p. c. (fluidextract, + diluted sulphuric acid 1, sugar 75, water q. s., dose, ʒj–2 (4–8 Ml. (Cc.)).

PROPERTIES.—Similar to tannin; tonic, mild astringent, carminative.

USES.—Uterine and other hemorrhages, aphthæ, ulcers of mouth, ears, anus, inflamed eyes, chapped hands, burns, flavoring vehicle, perfumery; ointment—soothing, emollient application to the skin, chapped hands and lips, abrasions, ulcers, frost-bite, etc.

Allied Plants:

1. *Rosa centifo'lia, Pale Rose.*—The petals, collected after expanding, official 1820–1900; W. Asia. Plant erect, 1–2 M. (3–6°) high, similar to but larger than *Rosa gallica;* stems covered with prickles, larger ones hooked; leaves imparipinnate, 2 pairs of opposite leaflets; flowers large, double, calyx persistent; fruit (hip) scarlet to orange-red, oblong, containing many 1-seeded achenes. Petals numerous, roundish-obovate, retuse, or obcordate, pink, fragrant, sweetish, slightly bitter, faintly astringent; contain volatile oil, mucilage, sugar, tannin, malates, phosphates (quercitrin?). This, although often mistaken for the Damask rose, is no doubt the most anciently cultivated variety of *R. gallica,* and exists in many hybrid forms which are employed indiscriminately. Used as mild carminative, for distilling the oil and *official* stronger rose water—the latter being of fine flavor, and more used in this country, owing to prevalence and cheapness, than the imported. Dose, gr. 15–60 (1–4 Gm.). *R. cani'na, Dog Rose,* United States; leaflets 5–7, ovate, serrate, flowers pink, white; *R. blan'da, R. nit'i-da,* also employed.

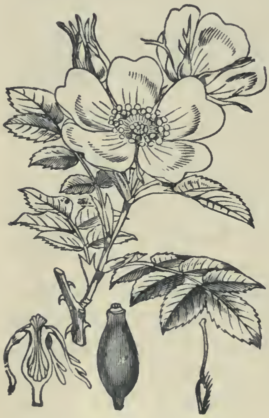


FIG. 158.—*Rosa canina.*

2. *R. damasce'na, Damascus Rose.*—The volatile oil distilled from fresh flowers, official 1880–1910; India, N. Africa, S. France, Bulgaria (Roumelia). Plant, prickly, resembling the ordinary rose bush, cultivated in hedge-like rows on southern slope of Balkan Mountains.

Oil (otto, attar of rose) pale yellow, transparent liquid, fragrant rose odor, mild sweetish taste, sp. gr. 0.860, alcohol (70 p. c.) precipitates stearoptene but dissolves eleoptene, congeals at 18–22° C. (64–72° F.); consists of solid portion (stearoptene) 12–14 p. c., being a mixture of odorless hydrocarbons, $C_{20}H_{42}$, etc., and a liquid portion (eleoptene) composed of (1) geraniol (rhodinol), $C_{10}H_{18}O$, 75 p. c., most fragrant, oxidized into aldehyde, citral (rhodinal), readily soluble in alcohol, (2) citronellol, $C_{10}H_{20}O$, small amount; when congealed should be liquefied by warming before dispensing. *Adulterations:* Spermaceti, paraffin (crystallize in opaque crust), fixed oils, volatile oils of guaiac-wood, palmarosa, rose geranium, etc.—having one or more similar ingredients (geraniol, etc.), recognized by congealing point and saponification value (10–17). Stimulant, carminative, aromatic; chiefly in perfumery, flavoring.

3. *Rubus villo'sus, R. nigrobac'cus, R. cuneifo'lius, Blackberry, Dewberry.*—The dried bark of the rhizome, official 1820–1910; N. America, fields, thickets, cult. Pubescent perennials; stems angular, woody, with stout recurved prickles; leaflets 3–5, ovate, cuneate, petiolate, serrate, rough above, pubescent beneath, 2.5–10 Cm. (1–4′) long; flowers white, racemes; fruit (aggregate drupe—carpels 20 +), 12–25 Mm. ($\frac{1}{2}$–1′) long, black, pulpy, delicious. Bark of rhizome 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, in long, tough, flexible bands or quills, 3–6 Mm. ($\frac{1}{8}$–$\frac{1}{4}$′) broad, brownish, grayish-brown, smooth or scaly, inner surface yellowish, coarsely striate, fracture tough-fibrous, readily splitting; inodorous; taste strongly astringent, bitterish; solvents: boiling water, diluted alcohol; contains tannin 12–17.5 p. c., gallic acid .4 p. c., villosin (saponin) .8 p. c., resin 7 p. c., volatile oil, fixed oil, wax, ash 3 p. c. Astringent, tonic, similar to tannin; diarrhœa—children and adults in summer. Dose, ʒss–1 (2–4 Gm.); fluidextract (diluted alcohol), ♏x–60 (.6–4 Ml. (Cc.)); syrup, 25 p. c., ʒj–4 (4–15 Ml. (Cc.)); decoction, 5 p. c. (water or milk), ℥j–2 (30–60 Ml. (Cc.)); syrup of fruit (juice 100, sugar 200—heat); wine; brandy.

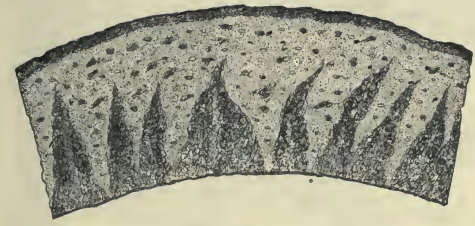


FIG. 159.—*Rubus villosus:* transverse section of bark, magnified 15 diam.

4. *R. Idæ'us, Raspberry.*—The fruit, official 1880–1900; Europe, N. Asia. Shrub 2 M. (6°) high, glaucous, spinose; leaves imparipinnate, 1–3 pairs, sessile, ovate, serrate, whitish, downy leaflets; flowers white, 5's. Fruit, deprived of conical receptacle (hollow

base), hemispherical, red, finely hairy, composed of 20–30 coalesced, small drupes, each one crowned with withered style, juice red; odor agreeable; taste pleasant, slightly acidulous; contains volatile oil (trace), citric acid, malic acid, sugar 5 p. c., pectin, coloring matter. Refrigerant, mild laxative, dietetic; used as edible fruit and for preparing syrup (juice 100, sugar 200—heat). The closely related light red fruit of *R. strigo'sus* (L. *strigilis*, set with stiff straight bristles), *Wild Red Raspberry*, and purplish-black fruit of *R. occidenta'lis*, *Black Raspberry*, *Thimbleberry*, may be substituted; both plants grow wild and under cultivation throughout N. America, supplying fruit that is in great demand, and a juice that ferments into wine, which upon distillation yields brandy more or less popular in bowel affections.

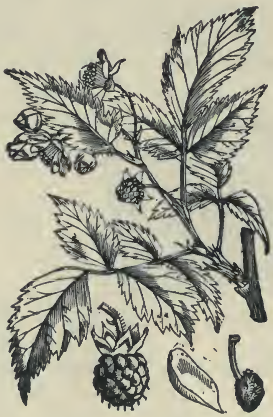


Fig. 160.—*Rubus Idæus.*

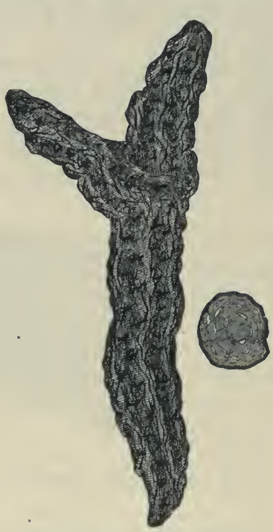


Fig. 161.—*Potentilla Tormentilla:* rhizome and transverse section.

5. *Ge'um riva'le, Purple* (*Water*) *Avens.*—The rhizome, official 1820–1880; N. America. Perennial plant .3–.6 M. (1–2°) high, stem purple; leaves 3-foliate or 3-lobed; flowers purplish-orange. Rhizome 5–7.5 Cm. (2–3′) long, 6 Mm. (¼′) thick, tuberculate, wrinkled, brownish-red; bark thin, wood-wedges white, pith large; aromatic, astringent, bitter; contains volatile oil, tannin, bitter principle. Used as astringent, tonic, in diarrhœa, hemorrhage, leucorrhœa, phthisis, scrofula, rheumatism, intermittents, dyspepsia, menstrual derangements; in decoction, infusion, tincture. Dose, gr. 15–30 (1–2 Gm.).

6. *Potentil'la Tormentil'la, Tormentil.*—The rhizome, official 1820–1880; Europe. Plant resembles *P. canaden'sis, Cinquefoil*, perennial, 25–30 Cm. (10–12′) high, green or reddish leaves, trifoliate; leaflets cuneate; flowers yellow; fruit achenes, reniform. Rhizome 5 Cm. (2′) long, 12 Mm. (½′) thick, tuberculate, brownish-red; bark thin, wood-

wedges small, distant; pith large, inodorous, astringent; contains tannin 25 p. c., red coloring matter (tormentil-red), kinovic acid, ellagic acid. Used as astringent, tonic like kino and catechu, for diarrhœa, dysentery, spongy gums (gargle), ulcers, gleet; in decoction, infusion. Dose, gr. 10–30 (.6–2 Gm.).

7. *Quilla'ja Sapona'ria, Soap Bark.*—The dried bark deprived of periderm, official 1880–1910; Chile, cult. in N. Hindustan. Tree, 15–18 M. (50–60°) high; leaves oval, evergreen, coriaceous; flowers white, monœcious; fruit capsule with persistent calyx, many-seeded. Bark in flat pieces of variable length, 3–8 Mm. ($\frac{1}{8}$–$\frac{1}{3}$′) thick, or small chips, whitish, often with cork patches, nearly smooth, occasional depressions, projections or channels; fracture uneven, fibrous; odor slight; taste acrid; powder strongly sternutatory; solvents: alcohol, hot water; contains saponin (quillajic acid, $C_{19}H_{30}O_{10}$ + quillaja-sapotoxin, $C_{17}H_{26}O_{10}$), $C_{32}H_{54}O_{18}$, 9 p. c., starch, gum, saccharose, calcium oxalate and sulphate. Stimulant, diuretic, expectorant, irritant, sternutatory, detergent, local anæsthetic, antipyretic, paralyzant to heart and respiration, irritant to respiratory passages, poison to voluntary muscles; like senega; bronchitis, coryza, rhinitis, emulsifying agent, eruptions, scalp sores, fetor of feet, hair tonics, washing silks. Dose, gr. 15–30 (1–2 Gm.); fluidextract, ♏v–15 (.3–1 Ml. (Cc.)); tincture, 20 p. c., ʒss–1 (2–4 Ml. (Cc.)).

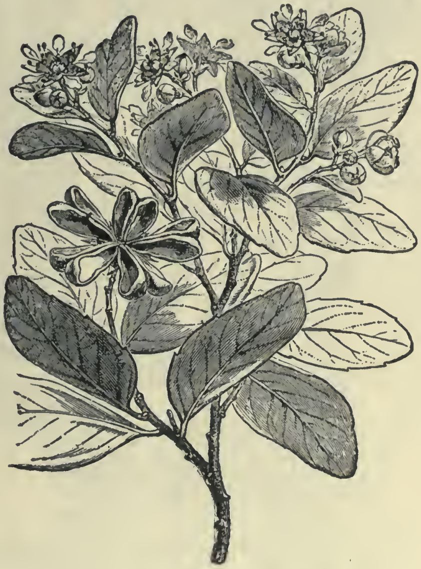


FIG. 162.—*Quillaja Saponaria.*

8. *Spiræ'a tomento'sa, Hardhack.*—The root, official 1820–1880; N. America; shrub, .6–1 M. (2–3°) high, stem ferruginous, tomentous, leaves dark green, but rusty-white beneath; flowers purple; fruit

1-seeded pod; root consists of brown, bitter, astringent bark, and hard, white, tasteless wood; contains tannin, bitter principle, volatile oil. Used as astringent, tonic in diarrhœa, cholera infantum, hemorrhages, gonorrhœa, ulcers, etc.; in infusion, decoction, extract. Dose, ʒss–1 (2–4 Gm.).

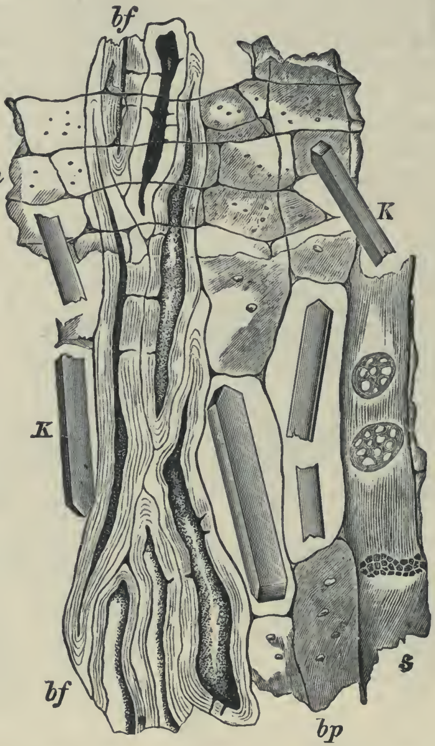


FIG. 163.—*Quillaja Saponaria*, longitudinal section: *bf*, bast-fibre; *bp*, sieve-parenchyma; *s*, sieve-tube; *m*, medullary ray; *K*, crystal.

9. *Porteran'thus stipula'tus* (*Gille'nia stipula'cea*), *Indian Physic*, and *P. trifolia'tus* (*G. trifolia'ta*), *American Ipecac*.—The root, official 1820–1880; United States; shrubs .6–1 M. (2–3°) high, stems reddish-brown, leaves trifoliate; leaflets 5–10 Cm. (2–4′) long, pubescent; flowers white, pink; root (rhizome) 12–25 Mm. ($\frac{1}{2}$–1′), thick, with thin bark and many-fissured rootlets, 3–6 Mm. ($\frac{1}{8}$–$\frac{1}{4}$′) thick, bitter; contains gillenin, resin, tannin. Used as emetic (substitute for ipecac), purgative, tonic; in infusion, decoction, tincture. Was very popular with North American Indians. Dose, emetic, gr. 15–30 (1–2 Gm.); tonic, gr. 2–5 (.13–.3 Gm.).

10. *Hage'nia abyssin'ica*, *Cusso*, *Kousso*, *Brayera*.—The dried panicles of the pistillate flowers, official 1860–1910; Abyssinia, table-lands, mountains. Ornamental tree, 6–12 M. (20–40°) high; leaves

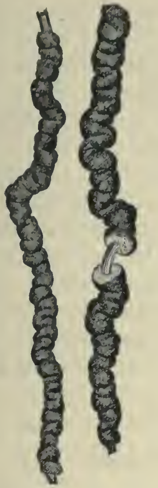


FIG. 164.—*Porteranthus stipulatus.*

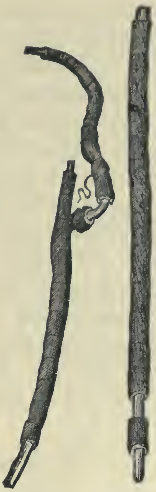


FIG. 165.—*Porteranthus trifoliatus:* rootlets, natural size.

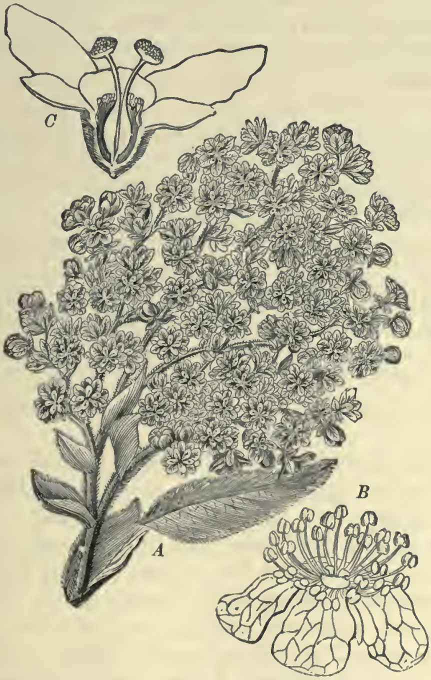


FIG. 166.—*Hagenia abyssinica: A*, branch of panicle; *B*, staminate flower; and *C*, pistillate flower, magnified 4 diam.

25–30 Cm. (10–12′) long, imparipinnate, leaflets 3–6 pairs, 7.5–10 Cm. (3–4′) long, sessile, serrate; flowers monœcious—staminate (Kousso-esels) greenish-yellow. Pistillate (Red kousso), panicles, in rolls or compressed bundles 25–40 Cm. (10–16′) long, brownish, each branch from axil of a sheathing bract, each flower with 2 rounded bracts at base, calyx-tube top-shaped, pubescent, bearing a circle of 5 purple-veined bracts resembling outer calyx, which are larger than the 5 usually shriveled, incurved oval calyx-lobes; 5 caducous petals, usually absent in drug; carpels 2; styles exserted, stigmas broad, hairy, odor slight, agreeable; taste bitter, acrid, nauseous; large stems should be rejected; solvents: alcohol, boiling water; contains kosin (amorphous resins) 6.25 p. c., volatile oil, tannin 24 p. c., kosidin, protokosin, kosotoxin, ash 5 p. c. Anthelmintic, tænifuge. Dose ℥ij–6 (8–24 Gm.); fluidextract (alcohol), ℥ij–6 (8–24 Ml. (Cc.)); kosin, gr. 5–30 (.3–2 Gm.).

32. DRUPACEÆ. Plum Family.

Dru-pa′se-e. L. *Drup-a* + aceæ, fr. Gr. *δρῦς*, tree, + *πέπτ-ειν*, ripen, *δρυπεπής*, ripened on the tree—*i. e.*, the stone fruit. Trees, shrubs. Distinguished by bark and seeds containing hydrocyanic acid (poisonous), the former exuding gum, bitter; calyx 5-lobed, campanulate; petals 5, on calyx, stamens many; pistil 1, ovary 1-celled, 2-ovuled; fruit drupe; temperate climates; tonic, astringent, sedative, nutritious, lumber.

Genus: **1. Prunus.**

PRUNUS VIRGINIANA. WILD CHERRY.

Prunus serotina, *Ehrhart.*
(**Prunus virginiana,** *Miller.*) { The stem-bark collected in autumn and carefully dried.

Habitat. N. America (Can. to Fla., to Minn., Neb., Kan., La., to Texas), in woods.

Syn. Prun. Virg., Wild Black Cherry Bark, Cabinet (Rum, Whisky, Blackchoke, Wild) Cherry; Br. Pruni Virginianæ Cortex, Virginian Prune Bark; Fr. Écorce de Cérisier de Virginie; Ger. Wildkirschenrinde.

Pru′nus. L. fr. *πρῦνη*, a plum tree; *prunum*, a plum—*i. e.*, classic name.

Se-rot′i-na. L. *serotinus*, fr. *serus*, late—*i. e.*, the latest of the genus to bloom and fruit.

Vir-gin-i-a′na. L. of, or belonging to Virginia—*i. e.*, Virginian.

Plant.—Large tree 9–24 M. (30–80°) high; trunk regular, straight, with blackish, rugged outside bark, that of young branches smooth, red or purplish; leaves 5–12.5 Cm. (2–5′) long, oval, petiolate, serrate, teeth glandular, glabrous, shining, bright green, with 2 small glands on the margin at the base; flowers May–June, appearing after the leaves, small, white, racemes; fruit August, drupe, size of a pea, purplish-black, pulpy, sweet, acidulous, slightly astringent and bitter—bitter cherries; seed subglobular, bitter almond flavor, containing bland, yellowish-green fixed oil 25 p. c. Bark, usually in tranversely curved pieces, 2.5–8 Cm. (1–3$\frac{1}{5}$′) long, 12–25 Mm. ($\frac{1}{2}$–1′) broad, .5–4 Mm.

$\frac{1}{50}$–$\frac{1}{6}$′) thick, light brown, greenish-brown, smooth, except numerous lenticels, 3–4 Mm. ($\frac{1}{8}$–$\frac{1}{6}$′) long; inner surface light brown, longitudinally striate, occasionally fissured, fracture short, granular; odor distinct, bitter, almond-like when macerated in water; taste astringent, aromatic, agreeably bitter. Powder, light brown; microscopically—bast-fibres, stone cells, crystal fibres, rosette aggregates of calcium oxalate, starch grains, .003–.004 Mm. ($\frac{1}{8325}$–$\frac{1}{6250}$′) broad. Young, thin bark best, and that from very large or small branches should be rejected. Should be kept dark, in tightly-closed containers. *Solvents:* hot or cold water. Dose, ʒss–1 (2–4 Gm.).

Adulterations.—Unrossed bark, that of old stems, also that of choke cherry, which closely resembles the official, but as a rule is either thinner or thicker, and breaks with a very tough fracture like slippery elm.

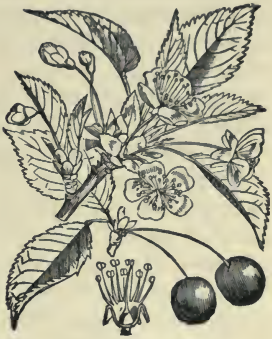


Fig. 167.—*Prunus serotina.*

Commercial.—The Latin official name, from its long usage, has been retained, although misleading; *Prunus virginiana* was given early by Linnæus to Choke Cherry, a shrub 2.5–3 M. (8–10°) high, having more sharply toothed leaves, shorter racemes, and astringent, dark red, crimson fruit, size of wild cherry. It has received various names at different times, as *Prunus ru'bra, P. obova'ta, P. virginiana, P. serotina, Cerasus serotina, C. virginiana.* The true official *Prunus serotina* grows in fertile soil in fields, woods, along fences, seldom in clusters; wood is valuable for furniture, being hard, red, fine-grained, and easily polished. Bark after collection is (rossed) deprived of outside layer (periderm or ross), exposing green phelloderm, and then dried; while that from all portions of the tree is used, that from the root is strongest, yet it all soon deteriorates, consequently only the fresh-dried should be employed; the average bark collected in April yields most starch, but least tannin, and hydrocyanic acid—.0478 p. c.; in June—.0956 p. c.; in Oct.—.1436 p. c. or $\frac{1}{7}$ gr. (.009 Gm.) from 100 gr. (6.5 Gm.) bark, which equals 7–8 ♏ (.5 Ml. (Cc.)) of official acid; young bark may yield of acid .183–.250 p. c., old bark .159–.335 p. c.

Constituents.—Amygdalin, Emulsin, Bitter principle, tannin 2–4.5 p. c., gallic acid, resin, starch, (volatile oil, hydrocyanic acid).

Amygdalin.—Glucoside, obtained by the action of alcohol; it is bitter, non-crystalline, and not precipitated by ether, hence in this differs from that in bitter almond.

Emulsin.—Ferment, extracted by water; white powder when pure, and by its action on amygdalin, in the presence of water, develops hydrocyanic acid and the volatile oil of bitter almond, neither of which, as such, existed previously in the bark. These two are obtained also by distilling the seeds with water, when they come over more or less mixed. The poisonous property of the oil depends largely upon the amount of acid present, and when freed of this, the oil becomes a bland, colorless liquid resembling that from bitter almond. Some think the ferment to be neither emulsin nor synaptase, but a closely analogous compound.

Bitter Principle.—Obtained by mixing soft aqueous extract with alcohol, shaking with milk of lime, evaporating filtrate, boiling residue with alcohol, evaporating, getting brown, bitter, gelatinous mass, which is insoluble in ether, soluble in alcohol, brownish-red with sulphuric acid.

PREPARATIONS.—1. *Syrupus Pruni Virginianæ.* Syrup of Wild Cherry. (Syn., Syr. Prun. Virg.; Br. Syrup of Virginian Prune; Fr. Sirop d'Écorce de Cerisier; Ger. Wildkirschenrindensirup.)

Manufacture: 15 p. c. Mix glycerin 5 Ml. (Cc.) with water 20 Ml. (Cc.), moisten wild cherry bark 15 Gm. with 10 Ml. (Cc.) of mixture, pack in percolator, add remainder of mixture, and enough water to saturate and leave stratum above, macerate for 24 hours, percolate with water q. s. 50 Ml. (Cc.), add sugar 80 Gm., dissolve by agitation, strain, pass through strainer water q. s. 100 Ml. (Cc.); mix thoroughly. Should be kept cool, in non-metallic, tightly-closed containers, as it rapidly loses hydrocyanic acid under most favorable conditions. Dose, ʒj–4 (4–15 Ml. (Cc.)); mainly for flavoring.

Unoff. Preps.: Fluidextract (glycerin 20, alcohol 20, water 60, finishing with 20 p. c. alcohol), dose, ʒss–1 (2–4 Ml. (Cc.)). *Infusion,* 4 p. c., dose, ℥ss–2 (15–60 Ml. (Cc.)). *Tinctura Pruni Virginianæ* (Br.), 20 p. c. + alcohol 62.5 p. c., finally add glycerin 10 p. c., dose, ʒss 1 (2–4 Ml. (Cc.)).

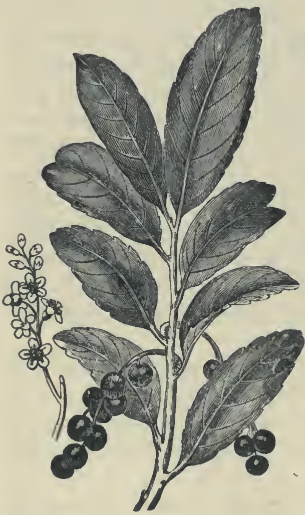


FIG. 168.—*Prunus Laurocerasus.*

PROPERTIES.—Sedative, pectoral, aromatic bitter tonic, astringent; increases appetite, digestion. Volatile oil—local stimulant on alimentary canal like cascarilla, serpentaria, etc. Hydrocyanic acid — sedative, nervine, large doses decrease heart action. Tannin is astringent.

USES. — Consumption, cough, bronchitis, scrofula, heart palpitation, stomach atony, dyspepsia, hectic fever, debility; cold infusion in ophthalmia. It is much inferior to cinchona in intermittents.

Allied Plants:

1. *Prunus domes'tica, Prunum, Prune.*—The partly dried ripe fruit, official 1820–1910; W. Asia, cult. in S. France, California. Tree, 4.5–6 M. (15–20°) high; leaves 5 Cm. (2′) long, dentate, ovate, pubescent

beneath; flowers whitish. Fruit (drupe), 2.5–4 Cm. (1–1$\frac{3}{5}$′) long, ellipsoidal, brownish-black, shriveled, sarcocarp sweet, acidulous, putamen hard, smooth or ridged; seed almond-shaped, but smaller, bitter almond taste. Of the several varieties, the St. Catherine and Greengage are finer as a dessert, and Prune de St. Julian (France) as a medicine; contains sugar 12–25 p. c., pectin, albumin, malic acid, tartaric acid, salts; seeds—fixed oil, amygdalin, emulsin. Nutritive, laxative, demulcent; constipation—skins indigestible; fermented and distilled for brandy, which contains alcohol 40 p. c. Dose, *ad libitum.*

2. *P. Laurocer'asus, Cherry Laurel.*—Leaves (fresh) official in some countries; W. Asia. Ornamental shrub or tree, 3–6 M. (9–20°) high; leaves 15 Cm. (6′) long, obovate, oblong, serrate, coriaceous; bitter almond odor; aromatic, bitter taste; contains laurocerasin, $C_{40}H_{67}NO_{30}$ (similar to amygdalin), emulsin, tannin, sugar, fat, wax, phyllic acid (crystalline, occurring also in leaves of almond, apple, maple, peach); yields hydrocyanic acid .12 p. c., and oil of bitter almond (benzaldehyde) .5 p. c., in which spring leaves are richest. Sedative, narcotic; used to make cherry laurel water (*Aqua Laurocerasi,* Br.) by distilling 400 Ml. (Cc.) from leaves 320 Gm. + water 1,000 Ml. (Cc.). Dose, ʒss–2 (2–8 Ml. (Cc.)).

AMYGDALA AMARA. BITTER ALMOND.

Oleum Amygdalæ Amaræ. Oil of Bitter Almond, *official.*

Prunus Amygdalus, var. **amara,** *DeCandolle.*	A volatile oil obtained by maceration and distillation, from the ripe kernels, and other kernels containing amygdalin.

Habitat. W. Asia, Persia, Syria, Barbary, Morocco; naturalized in Mediterranean Basin; cultivated in Europe; unsuccessfully in United States.

Syn. Greek Nuts; Ol. Amygd. Amar., Bitter Almond Oil, Oleum Amygdalarum (Amararum) Æthereum; Fr. Amande amère; Essence d'Amande amère; Ger. Amygdalæ Amaræ, Bittere Mandeln; Bittermandelöl.

A-myg'da-lus. L. fr. Gr. *αμύσσω,* to lacerate—*i. e.,* its fissured shell.

A-ma'ra. L. *amarus,* bitter—*i. e.,* the fruit.

Plant.—Small tree, 5–6 M. (15–20°) high, bark purplish; leaves bright green; flowers pale pink or white; fruit drupe, ovate, 5 Cm. (2′) long, 2.5 Cm. (1′) broad, sarcocarp green, leathery, splitting into two halves when ripe, and falling from the stone. This remaining stone is the commercial almond, and may be sold as such or may be bleached by sulphur dioxide, thereby also killing any attached insects. By cracking off hard shell the kernel, or, properly, the seed, is left, which, when deprived of papery endocarp by hot water, constitutes the more desirable blanched almond. Seed (almond), 2.5 Cm. (1′) long, oblong-lanceolate, flattish; testa cinnamon-brown, thin, finely downy, marked by about 16 lines radiating from broad scar at blunt end; embryo straight, white, oily, with 2 plano-convex cotyledons;

taste bitter, oleaginous; triturated with water yields milk-white emulsion, emitting odor of hydrocyanic acid.

Adulterations.—Seed: Sweet almonds chiefly (Valencia) and peach seeds—both cheaper; the bitter differs from the sweet in flavor, odor with water, containing amygdalin, being shorter, broader, thinner, less plump and darker, and from peach seeds by being much larger; Oil: Alcohol, oil of turpentine, nitrobenzene, impure benzaldehyde from toluene (chlorine), etc.

Commercial.—There are several varieties of these (*French, Sicily, Barbary,* in the order of value), being exported chiefly from Mogador, in Morocco.

Constituents.—Kernels: Fixed oil 46 p. c., Amygdalin 1–3 p. c., Emulsin (mucilage 3 p. c., proteids (myosin, vitellin, conglutin) 24–30 p. c., precipitated by acetic acid, sugar 6 p. c., ash 3–5 p. c.—K, Ca, Mg —phosphates); yield volatile oil 1 p. c.; hydrocyanic acid .25 p. c.

Amygdalin, $C_{20}H_{27}NO_{11}$.—A crystalline glucoside obtained from expressed cake (deprived of fixed oil) by boiling in alcohol, distilling to syrup, adding water and yeast, and then allowing fermentation; after this, filter, evaporate to syrup, add alcohol to precipitate amygdalin and gum, from which boiling alcohol takes up the former, depositing it upon cooling.

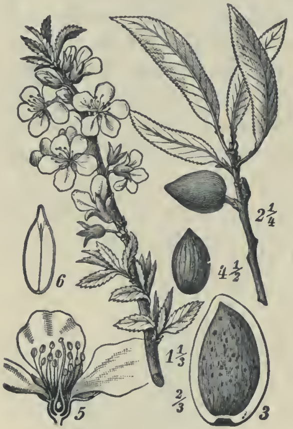


Fig. 169.—*Prunus Amygdalus:* *1*, flowering twig; *2*, twig, with fruit; *3*, fruit hull cracked off; *4*, seed deprived of hull; *5*, vertical section of flower; *6*, longitudinal section of seed.

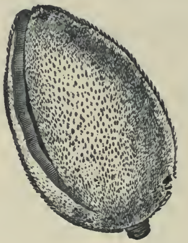


Fig. 170.—*Prunus Amygdalus:* fruit in the act of opening.

Emulsin (*synaptase*).—A ferment coagulated by heat, precipitated by alcohol, but not by acetic acid, and in the presence of water, acts upon amygdalin, forming glucose, $C_6H_{12}O_6$, hydrocyanic acid, HCN (1 part being formed from 17 of amygdalin), and benzaldehyde, C_7H_6O—oil of bitter almond 1–4 p. c.; $C_{20}H_{27}NO_{11} + 2H_2O = 2(C_6H_{12}O_6) + HCN + C_7H_6O$.

Oleum Amygdalæ Amaræ. Oil of Bitter Almond.—This volatile oil, like volatile oil of mustard, oil of gaultheria, and methyl salicylate, does not preëxist in the kernels (seeds), but results from macerating for 12 hours the expressed cake of bitter almonds with water, wherein amygdalin undergoes fermentation, then distilling the oil formed by passing steam through the mixture; kernels of the peach (*P. Persica*) and apricot (*P. armeni'aca*) yield much of the commercial oil, which may also be prepared synthetically from toluene (see benzaldehydum, below). It is a clear, colorless, yellowish, strongly refractive liquid, characteristic odor and taste of benzaldehyde, soluble in alcohol, ether, slightly in water, forms clear solution in 2 vols. of 70 p. c. alcohol; sp. gr. 1.038–1.060, optically inactive or dextrorotatory; at first neutral, but becomes acid from the formation of benzoic acid; contains 85 p. c. of benzaldehyde, C_6H_5CHO, and 2–4 p. c. of hydrocyanic acid, HCN (sometimes as much as 8–10 p. c.); when freed from this latter it is less poisonous, but even then has a marked physiological action on the nervous system. *Impurities:* Nitrobenzene, chlorinated products, heavy metals. The label must indicate definitely its specific source, as this is intended for medicinal use, and not for flavoring foods. Should be kept dark, air-tight, in small, well-stoppered, completely filled, amber-colored bottles, and when showing crystals of benzoic acid must not be dispensed. Dose, ♏$\frac{1}{4}$–1 (.016–.06 Ml. (Cc.)).

PREPARATIONS.—OIL: 1. *Aqua Amygdalæ Amaræ.* Bitter Almond Water. (Syn., Aq. Amygd. Amar.; Fr. Eau d'Amande amère; Ger. Bittermandelwasser.)

Manufacture: $\frac{1}{10}$ p. c. Dissolve oil .1 Ml. (Cc.) by agitation in recently boiled distilled water q. s. 100 Ml. (Cc.), filter; contains mere trace of hydrocyanic acid, and differs from the International Protocol preparation (1906) containing .1 p. c. of hydrocyanic acid. Dose, ʒj–3 (4–12 Ml. (Cc.)); mostly as a flavor.

2. *Spiritus Amygdalæ Amaræ.* Spirit of Bitter Almond. (Syn., Sp. Amygd. Amar., Essence of Bitter Almond; Fr. Alcoolat (Esprit) d'Amande amère; Ger. Bittermandelgeist.)

Manufacture: 1 p. c. Dissolve oil 1 Ml. (Cc.) in alcohol 80 Ml. (Cc.), add distilled water q. s. 100 Ml. (Cc.). Dose, ♏xv–30 (1–2 Ml. (Cc.)).

Unoff. Preps.: Syrup (spt. of bitter almond 1, orange flower water 10, syrup q. s. 100), dose, ʒij–4 (8–15 Ml. (Cc.)). *Comp. Elixir* (oil $\frac{1}{20}$ p. c.).

PROPERTIES.—Demulcent, nutrient, sedative; often produces urticaria.

USES.—Coughs, pulmonary troubles, flavoring.

Poisoning: Here have hydrocyanic acid symptoms; hence give emetics to induce vomiting, galvanism, brandy, whisky, ammonia to nostrils, etc.

Allied Products:

1. **Benzaldehydum.** Benzaldehyde, C_7H_6O, *official.*—(Syn., Benzaldehyd., Oleum Amygdalarum Æthereum (Artificiale)-sine Acide Prussico, Synthetic Oil of Bitter Almond; Fr. Aldehyde benzoique; Ger. Kunstliches Bittermandelöl.) An aldehyde produced synthetically or from oil of bitter almond, containing 85 p. c. of benzaldehyde.

Manufacture: 1. Shake oil of bitter almond (peach, apricot, etc.) with concentrated solution of acid sodium sulphite (3) to form crystalline benzalhydroxysulphonate, wash with cold alcohol, treat with strong sodium carbonate solution, rectify by distillation with steam. 2. Treat boiling toluene, C_7O_8, with chlorine, heat resulting benzyl chloride with barium nitrate and water, while passing carbon dioxide through the mixture, the benzyl nitrate formed decomposes into benzaldehyde and oxides of nitrogen. It is a colorless, yellowish, refractive liquid, bitter almond-like odor, burning aromatic taste, slightly soluble in water, miscible with alcohol, ether, fixed or volatile oils; sp. gr. 1.045; differs from oil of bitter almond in having no hydrocyanic acid. *Tests:* 1. Shake 10 drops with distilled water (5 Ml. (Cc.)), + potassium hydroxide T. S. (.5 Ml. (Cc.)), + ferrous sulphate T. S. (.1 Ml. (Cc.)), warm gently, + excess of hydrochloric acid—no greenish-blue color nor blue precipitate within 15 minutes (abs. of hydrocyanic acid). 2. Dissolve 1 Ml. (Cc.) in alcohol (20), + distilled water until turbid, evolve hydrogen 1 hour by adding zinc and diluted sulphuric acid, filter, evaporate to 20 Ml. (Cc.); of this boil 10 Ml. (Cc.) + a drop of potassium dichromate T. S.—not violet (abs. of nitrobenzene). *Impurities:* Hydrocyanic acid, chlorinated products, nitrobenzene. Should be kept dark, in small, well-stoppered bottles. Dose, ♏$\frac{1}{4}$–1 (.016–.06 Ml. (Cc.)).

Properties and Uses.—Similar to oil of bitter almond; largely as a flavoring agent, having the advantage of the oil in being devoid of hydrocyanic acid, and not being poisonous except in large quantities.

2. *Nitrobenzene, Nitrobenzol, Oil of Mirbane.*—False artificial oil of bitter almond is obtained by acting on benzene with nitric acid. It is very poisonous, has the true bitter almond oil odor, owing to which substitution has been made with fatal results.

AMYGDALA DULCIS. SWEET ALMOND.

Prunus Amygdalus, var. **dulcis,** *DeCandolle.* } The ripe seeds.

Habitat. W. Asia, Persia, Syria, Barbary, Morocco; naturalized in Mediterranean Basin; cultivated in Europe, S. California.

Syn. Amygd. Dulc., Jordan Almond, Malaga, Paper-shell, Greek Nuts; Fr. Amande(s) douce(s); Ger. Amygdalæ dulces, Susse Mandeln.

Dul′cis. L. sweet—*i. e.*, the fruit.

Plant.—Small tree, 5–6 M. (15–20°) high, bark purplish; leaves bright green; flowers pale pink or white; fruit drupe, ovate, 5 Cm. (2′) long, 2.5 Cm. (1′) broad, sarcocarp green, leathery, splitting into two halves when ripe, and falling from the stone. This remaining stone is the commercial almond, and may be sold as such or may be bleached by sulphur dioxide, thereby also killing any attached insects. By cracking off hard shell the kernel, or, properly, the seed, is left, which, when deprived of papery endocarp by hot water, constitutes the more desirable blanched almond. Seeds (almond), 17–25 Mm.

($\frac{3}{4}$–1′) long, 10–13 Mm. ($\frac{2}{5}$–$\frac{1}{2}$′) broad, 4–7 Mm. ($\frac{1}{6}$–$\frac{1}{3}$′) thick, oblong-lanceolate; seed-coat light brown with numerous parallel veins, thin, easily removed by soaking in water; embryo straight, white, 2 plano-convex cotyledons; taste bland, sweet; triturated with water—milk-white, non-acid emulsion having no odor of benzaldehyde, hydrocyanic acid (abs. of bitter almond). Powder, creamy-white; microscopically—numerous small and large oil globules, crystalloids, globoids, fragments of parenchyma of endosperm and seed-coat, aleurone grains, spiral tracheæ; no starch grains.

Commercial.—Of these there are several varieties (*Jordan, Valencia, Sicily, Barbary,* in the order of value), imported chiefly from Spain, S. France, via Marseilles or Bordeaux (*soft-shelled;* var. *frag′ilis*), and Malaga (*Jordan* or *long*) or Valencia (*hard-shelled*), being larger and longer than the var. *amara,* with more convex sides. The Jordan only, owing to easy recognition, are used in the Br. P. To preserve almonds, should keep dry, thereby preventing decomposition of amygdalin and fixed oil; when rancid the embryo has changed into gum bassorin, which renders them unfit for medicinal use.

Constituents.—Fixed oil 56 p. c., Emulsin (mucilage 3 p. c., sugar 6 p. c., proteids (myosin, vitellin, and conglutin) 24–30 p. c., precipitated by acetic acid, ash 3–5 p. c.—K, Ca, Mg—phosphates); the *testa* of both varieties contain tannin.

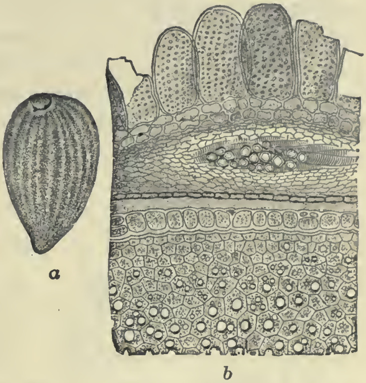


Fig. 171.—*Prunus Amygdalus: a,* seed-kernel; *b,* section through seed-coats and portion of cotyledon.

Oleum Amygdalæ Expressum. Expressed Oil of Almond. *official.*—(Syn., Ol. Amygd. Exp., Oil of Sweet Almond, Oleum Amygdalæ Dulcis; Br. Oleum Amygdalæ, Almond Oil; Fr. Huile d'Amande (douce); Ger. Oleum Amygdalarum, Mandelöl.) This fixed oil is obtained from both varieties of almonds (sweet and bitter) by grinding or bruising in an iron or stone mortar the clean and perfect kernels, enclosing mass in canvas bags and subjecting them to hydraulic pressure of 350 atmospheres between polished steel plates slightly heated (30° C.; 86° F.); the expressed turbid oil is set aside in a cool place, decanted from sediment and filtered; most of the commercial oil is from the bitter almonds prior to preparing the volatile oil. It is a clear, pale straw-colored, colorless, oily liquid, almost odorless, bland taste; slightly soluble in alcohol, miscible with ether, chloroform, benzene, petroleum benzin; sp. gr. 0.912; contains triolein 75–85 p. c., tripalmitin, trilinolein. *Tests:* 1. Clear at —10° C.; 14° F., congeals at —20° C.; —4° F. (abs. of olive, cottonseed, sesame, lard oils, congealing at —5° C.; 22° F., apricot and peach oils remaining fluid at —20° C.;

—4° F.). 2. Shake vigorously oil (2), fuming nitric acid (1), water (1)—whitish mixture, which on standing several hours at 10° C. (50° F.) separates solid white mass and slightly colored liquid (peach, apricot oils—red color; sesame, cottonseed oils—brown. Should be kept cool, in well-closed containers. Dose, ℥j–2 (30–60 Ml. (Cc.)).

ADULTERATIONS.—Olive, arachis (ground-nut), lard, cottonseed, sesame, poppy, apricot and peach oils; apricot kernels yield 25–38 p. c. of oil, which, with peach oil, is substituted often (in part or entire, for the pure article.

PREPARATIONS.—I. SEED: 1. *Emulsum Amygdalæ.* Emulsion of Almond. (Syn., Emuls. Amygd., Milk of Almond; Br. Mistura Amygdalæ, Almond Mixture, Simple Emulsion; Fr. Lait d'Amande(s); Ger. Mandelmilch.)

Manufacture: 6 p. c. Triturate, until thoroughly mixed, blanched sweet almonds 6 Gm., acacia 1 Gm., sugar 3 Gm., then rub mass with water 90 Ml. (Cc.), gradually added, until homogeneous, strain, add water q. s. 100 Ml. (Cc.), mix thoroughly. Must not be dispensed unless recently prepared. Dose, ʒij–4 (8–15 Ml. (Cc.)).

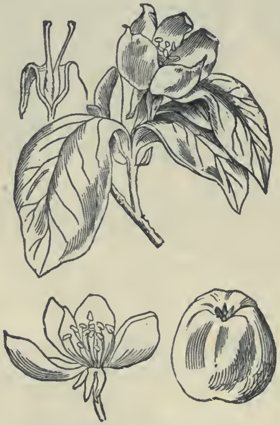


FIG. 172.—*Cydonia (Pyrus) Cydonia.*

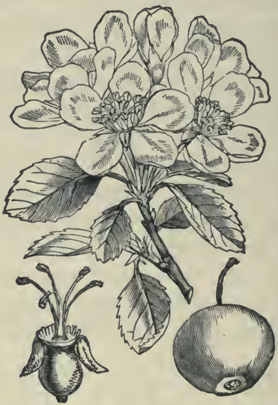


FIG. 173.—*Malus (Pyrus) Malus.*

II. OIL: 1. *Emulsum Olei Terebinthinæ,* 5 p. c. 2. *Unguentum Aquæ Rosæ,* 56 p. c.

Unoff. Prep.: Pulvis Amygdalæ Compositus (Br.)—seed 60 parts, + sugar 30, acacia 10.

PROPERTIES.—Demulcent, nutrient, laxative.

USES.—The meal of the expressed cake as a toilet powder, and since it contains no starch it may readily be made into bread, cake, puddings, etc., which is excellent for diabetics. Seed very popular as a confection. Expressed oil, employed like olive oil, also for pulmonary trouble.

Allied Plants:

1. *Amygdalus (Prunus) Per'sica, Peach.*—Persia, cultivated largely in the United States, etc. Fruit edible, abounding in sugar, juice

ferments, and upon distillation yields peach brandy; kernels poisonous from yielding HCN, often substituted for bitter almonds, also contain fixed oil resembling that of almond, for which it is an adulterant; leaves mild sedative in doses of gr. 15–30 (1–2 Gm.), in infusion.

2. *Cydo'nia* (*Py'rus*) *Cydonia, Quince.*—Pomaceæ. The seed, official 1850–1890; W. Asia. Tree 2.5–6 M. (8–20°) high, with crooked, straggling branches; leaves like pear leaves; flowers white or purplish; fruit pear-shaped; seed 6 Mm. (¼′) long, ovate, triangular, brown, covered with whitish, mucilaginous epithelium, causing seeds of each cell to adhere; swell with water, forming heavy mucilage; 2 cotyledons, white, oily, bitter almond taste; very similar to apple seeds; contain mucilage (cydonin) 20 p. c. (not precipitated by borax or potassium silicate, soluble in cold and hot water), fixed oil, proteids; used as demulcent, protective; fruit astringent. *Mucilago Cydonii* (1 part + water 50), official 1880–1890.

3. *Ma'lus* (*Pyrus*) *Malus, Apple.*—Plant resembles quince; fruit edible, laxative; bark tonic, febrifuge. Dose, gr. 15–60 (1–4 Gm.); succus pomorum.

33. MIMOSACEÆ. Mimosa Family.

Mi-mo-sa'se-e. L. *Mimos-a* + aceæ, fr. L. *mimus*, Gr. μῖμος, a mimic—*i. e.*, the leaves often mimic or imitate animal sensibility, moving by slight impulse, partly closing when touched, etc. Herbs, shrubs, trees. Distinguished by leaves compound, 2–3 pinnate (sometimes phyllodia); calyx 3–6-toothed or lobed, corolla 3–6's, stamens distinct or monadelphous, ovary 1-celled, ovules several; fruit, legume; tropics, temperate climates; tonic, astringent, demulcent, nutritive, dye.

Genus: **1. Acacia.**

ACACIA. ACACIA.

Acacia Senegal, *Willdenow*, and other African species. } The dried, gummy exudation.

Habitat. E. and W. Africa, Senegal, Kordofan, Egypt, Abyssinia, India, Nubia, Upper Nile.

Syn. Acac., Gum Arabic, Gum Senegal, Egyptian Thorn, Indian Gum Tree, Babla(c)h Pods, Acacia bambolah, Gummi Africanum or Mimosæ; Br. Acaciæ Gummi, Gum Acacia; Fr. Gomme arabique du Sénégal; Ger. Gummi arabicum, Arabisches Gummi.

A-ca'cia. L. fr. Gr. ἀκακία, a thorny Egyptian tree, fr. ἀκή, a point—*i. e.*, tree studded with thorns.

Sen'e-gal. L. belonging to Senegal, a country and river in W. Africa—*i. e.*, the plant's original and present habitat.

Arabic—misnomer, as Arabia produces little and exports none.

Plant.—Shrubby tree, 6 M. (20°) high; stem tortuous with terete branches, nodes with 3 short, black-tipped spines subtending the leaves; bark smooth, grayish-brown; leaves alternate, bipinnate, paripinnate, 2.5–4 Cm. (1–1⅗′) long; pinnæ 3–5 pairs; leaflets sessile, 10–20 pairs, grayish-green, 4 Mm. (⅙′) long; flowers yellow, spikes; fruit (pod), loment, compressed, smooth, pale, 7.5–10 Cm. (3–4′)

long, 18 Mm. ($\frac{3}{4}'$) broad, 2–6-seeded. Gum (acacia), in ovoid, spheroidal tears, broken, angular fragments, 2–30 Mm. ($\frac{1}{12}$–$1\frac{1}{5}'$) broad, whitish, yellowish, amber-colored, translucent, brittle; fracture glass-like, sometimes iridescent; nearly inodorous; taste insipid, mucilaginous; insoluble in alcohol, slowly and almost completely soluble in water (2), forming mucilaginous liquid of slight, characteristic odor and acid reaction. *Tests:* 1. Aqueous solution (1 in 10) 10 Ml. (Cc.), + basic lead acetate T. S. (.1), or + ferric chloride T. S. (.1), or + concentrated solution of sodium borate (.1), or + alcohol—gelatinous precipitate. 2. With iodine T. S.—not blue (lim. of starch), nor red (abs. of dextrin); does not reduce alkaline cupric tartrate V. S. 3. Precipitate with ferric chloride T. S.—neither black nor brownish-black (abs. of tannin). Powder, whitish, few or no starch grains nor vegetable tissue fragments; should contain not more than 15 p. c. of moisture, and not more than 1 p. c. should be insoluble in water (lim. of plant tissues, sand, dirt). Dose, *ad libitum.*

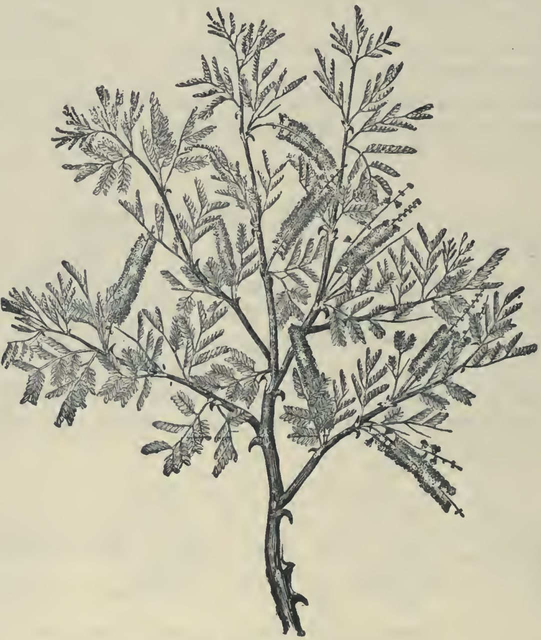


Fig. 174.—*Acacia Senegal.*

Adulterations.—Gum: Inferior, dark colored, opaque and insoluble gums, bdellium, rock salt, ligneous and earthy substances, dextrin in lumps; Powder: Flour, rice flour, starch, dextrin—all recognized by solubility, viscosity, the microscope, and iodine test. The gum from quince seed, flaxseed, Irish moss, etc., often used as a substitute.

Commercial.—Plants grow associated with little other vegetation in sandy soil, deserts, forming entire forests. Gum, a degenerative product, the result of "gummosis"—transformation of cell contents (cellulose) in the cambium, cortex, and adjacent parenchyma, a process favored in dry hot seasons and unhealthy trees—exudes as a thick juice through fissures caused by dry winds after the rainy season, or artificial incisions, and sooner or later, whereby depends color, hardens on the bark similar to our cherry, apple, or plum gum. It is collected Oct.-Dec., some in March, by the Moors and negroes, who in caravans enter the acacia forests and gather it in leather sacks, detaching adherent lumps with wooden axes and picking up fallen pieces from the ground. It enters market in bags, boxes, casks, skins, mostly from Egypt, via Cairo, Alexandria, Trieste, where it is received as unassorted acacia, "acacia in sorts"—the aggregated product of various species, assorted into "first picked," "second picked," etc., down to sorts (unworthy of assorting)—there being recognized at Trieste thirty-two grades. Acacia is known by the natives as *Verek* (Senegal) or *Hashabi* (E. Africa), the best being white, opaque, and chiefly from *A. Senegal* (*Ve'rek*) and *A. arabica* (*vera*), which grow promiscuously with other species and contribute the several varieties: 1, *Turkey* (*Egyptian*), which includes (*a*) Kardofan (*A. Senegal*), from west of White Nile, once constituting the bulk of the superior gum, (*b*) Sennaar (*A. fis'tula, A. stenocar'pa*), from east of White Nile, inferior, mucilage sours quickly, (*c*) Suakin (Talca—*A. stenocarpa, A. Se'yal*), from near Red Sea, mixture of white and brown pieces, very brittle, usually semi-pulverulent, only soluble with alkali; 2, *Senegal* (*A. Senegal*), from north of Senegal River, W. Africa, being controlled by France and shipped to Bordeaux; larger than Turkey gum, some nodules the size of a pigeon egg, less brittle, more yellow or reddish, with fewer cracks and more conchoidal fracture, not amber-yellow when heated with potassium hydroxide, as are Turkey gum and dextrin solutions; 3, *Barbary* (*Morocco, Mogador—A. nilot'ica, A. arabica*), collected July–August, consisting of two kinds that enter Mogador, one from Morocco (resembling Turkey), the other from Timbuctoo (resembling Senegal), both in more or less brownish, roundish tears, brittle, soluble in water; 4, *India* (*A. arabica*, +), from Somali districts, E. Africa, conveyed by Arab vessels to Bombay; resembles somewhat Turkey and Senegal gums, however, much mixed and often containing Bassora gum or allied substances (insoluble, swelling and softening with water into viscid mass), also resinous products resembling turpentines; deprived of these the variety is well suited for general use.

Gums are produced also by other *Acacia* species in Morocco, Cape Colony, Australia (Wattle gum), Brazil (Para, Angico gum), etc.; Mezquite gum (*Proso'pis juliflo'ra*), Texas, California, New Mexico, Chile, resembles acacia, but is yellow, brown, and not precipitated by lead subacetate, ferric chloride, borax; also considerable gum from plants of different genera and family, darker color but resembling the official.

Powdered acacia occurs in two forms: 1, *Granulated* (*sanded*), to produce which the gum needs to lose only 2 p. c. of moisture; 2, *Finely powdered (dusted)*, in which the gum must lose 10 p. c. of moisture to produce a sufficiently fine powder—a process that renders it more lumpy and less soluble in water.

CONSTITUENTS.—Arabic acid, $C_{12}H_{22}O_{11}$, combined with Ca, Mg, K—arabates; sugar (trace), moisture 14 p. c., ash 3–4 p. c.

Arabic Acid (*gummic acid, arabin*).—A glucoside obtained by adding alcohol to acidified (HCl) mucilage. After drying, it swells with water, but dissolves only upon the addition of an alkali; boiled with acids yields arabinose (arabin sugar, pectinose, pectin sugar), $C_5H_{10}O_5$, in prismatic crystals, sweet, but not directly fermentable, and possibly also galactose, granular and less sweet.

PREPARATIONS.—1. *Mucilago Acaciæ.* Mucilage of Acacia. (Syn., Mucil. Acac.; Fr. Mucilage de Gomme; Ger. Mucilago Gummi arabici, Gummischleim.)

Manufacture: 35 p. c. Wash acacia 35 Gm. in a tared bottle (flask) with sufficient cold water, discard washings, drain, add warm distilled water q. s. 100 Gm.; securely stopper the container, agitate until dissolved, strain. Must be made frequently and not dispensed if sour or moldy. Should be kept cool (refrigerator) in small, well-filled bottles. When cold or hot water employed alone acetic acid is formed from the acid calcium arabate, which may be neutralized by lime water (35 p. c.), or retarded by alcohol (6 p. c.), glycerin (10 p. c.), acetanilid (.4 p. c.), or chloroform (.5 p. c.). Dose, *ad libitum.*

2. *Syrupus Acaciæ.* Syrup of Acacia. (Syn., Syr. Acac.; Fr. Sirop de Gomme; Ger. Syrupus Gummosus, Gummisirup.)

Manufacture: 10 p. c. Dissolve acacia 10 Gm. in distilled water 43 Ml. (Cc.), occasionally stirring, add sugar 80 Gm., heat gradually on water-bath until contained water boils, maintain temperature for 15 minutes, and stir occasionally until sugar dissolved, strain (hot), add distilled water, recently boiled, q. s. 100 Ml. (Cc.); while hot pour into small, well-rinsed, well-dried bottles, insert tightly rubber stoppers just boiled in water for 30 minutes, cap with paper; sometimes spoils in hot weather. Dose, *ad libitum.*

3. *Emulsum Amygdalæ,* 1 p. c. 4. *Emulsum Olei Morrhuæ,* 12.5 p. c. 5. *Emulsum Olei Terebinthinæ,* 15 p. c. 6. *Mistura Glycyrrhizæ Composita,* 3 p. c. 7. *Pilulæ Ferri Iodidi,* $\frac{1}{7}$ gr. (.01 Gm.). 8. *Pilulæ Phosphori,* $\frac{1}{2}$ gr. (.03 Gm.). 9. *Pulvis Cretæ Compositus,* 20 p. c. 10. *Trochisci Cubebæ,* 2 gr. (.13 Gm.).

Unoff. Preps.: Emulsions. Pills. Troches, etc.

PROPERTIES.—Demulcent, emollient, protective, nutritive. Forms often the food of Hottentots and camels. By its viscidity sheaths inflamed surfaces; as a diluent, lessens acrimony of irritating medicines.

USES.—Coughs, laryngitis, gastritis, typhoid fever, dysentery, diarrhœa. Fine powder locally stops slight hemorrhage; thick mucilage protects burns, ulcers, etc. In pharmacy used to suspend insoluble substances in water—emulsifying oleoresins, fixed and volatile oils, for adhering pills, troches, etc.; in arts for giving lustre to fabrics, silks, thickening colors, mordants, suspending iron tannate in ink, etc. The bark of tree for dyeing, tanning, as it contains tannic and gallic acids.

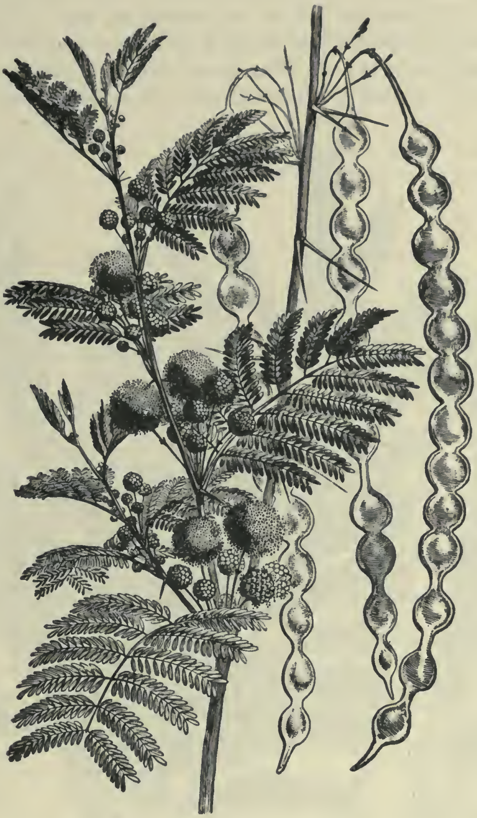


FIG. 175.—*Acacia arabica.*

Allied Plants:

1. *Acacia Cat'echu, Catechu.*—An extract prepared from the heartwood, official 1820–1900; India, Hindustan. Plant crooked, shrubby tree, 4.5–12 M. (15–40°) high, 15–45 Cm. (6–18′) thick, bark brown, wood whitish and reddish, leaves paripinnate, pinnæ in 10–20 pairs, with a pair of hooked, brown prickles at each base, leaflets 20–30 pairs in each pinna, flowers yellow, fruit, pod (loment), brown, flat, 5–12.5 Cm. (2–5′) long, seed 3–10, brown, shining; extract (catechu) in irregular masses, dark brown, brittle, porous, fracture conchoidal, little glossy, inodorous, taste sweetish, astringent. It is prepared by removing bark and sapwood, and boiling in water the reddish-black heartwood, cut in chips, for about 12 hours, straining, evaporating, stirring frequently and vigorously to improve the product—over-boiling being

injurious, as it converts catechin into catechu-tannic acid; when of syrupy consistency it is cooled somewhat and poured into clay molds or on leaves, mats, etc., previously dusted with cow-dung ashes; by morning it is hard, brittle, when it is broken up into suitable pieces for market; contains catechu-tannic acid 35 p. c., catechin 13–34 p. c., quercetin, gum, extractive. There are several varieties: 1, Plano-convex (Cake); 2, Pegu; 3, Quadrangular (Cake), Bengal; 4, Ball, Bombay. *Adulterations:* Largely with leaves, mats, cloths, sticks, sand, ferrous carbonate, sometimes to 65 p. c.; artificial variety made from roasted mahogany, walnut, etc. Astringent, tonic, similar to tannic acid—much more harsh than gambir, owing to which it is used chiefly for tanning, arts, etc.; diarrhœa, leucorrhœa, gonorrhœa, chronic sore throat, relaxed uvula, spongy gums (mouth wash), hemorrhages, bronchitis. Dose, gr. 5–30 (.3–2 Gm.); compound tincture, 10 p. c. (diluted alcohol), dose, ʒss–2 (2–8 Ml. (Cc.)); fluidextract;

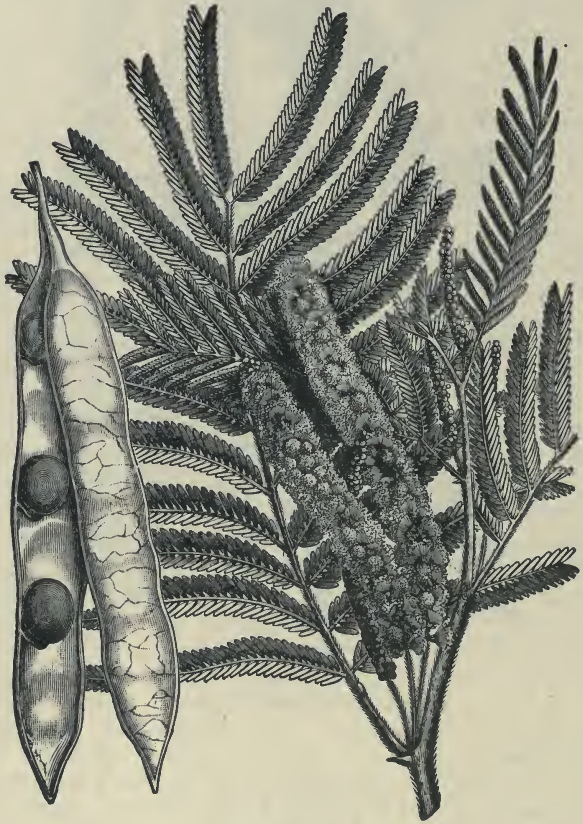


FIG. 176.—*Acacia Catechu.*

infusion. *A. arab'ica* (*ve'ra*), bark reddish-brown, spines and fruit long; *A. gummif'era, A. Ehrenbergia'na, A. Adanso'nii, A. tor'tilis, A. Fis'tula*, and several others give valuable gums. *A. Su'ma* differs from *A. Catechu* only in its white bark, more leaflets, shorter corolla, and stronger spines; S. India, E. Africa (forests), S. America once furnished most of the commercial catechu, and still some; the bark used in tanning. *A. arabica, Babul Bark*, India; furnishes good extract; the fruit contains tannin 22 p. c.

2. *Ar'eca Cat'echu, Areca* or *Betel Nut.*—Palmaceæ (see page 96). Palm tree cultivated in India. Extract made by evaporating decoction of the powdered nuts.

34. CÆSALPINIACEÆ. Senna Family.

Ses-al-pin'i-a'se-e. L. *Cæsalpin-us*(*-i*) + aceæ, after Andreas Cæsalpinús (1519–1603), a noted Italian botanist and physician. Trees, herbs, shrubs. Distinguished by leaves compound, bipinnate, stipulate, stems often prickly; flowers yellow, red, calyx 5's, petals 5, upper one enclosed by lateral ones in bud; fruit legume, dehiscent; tropics; astringent, cathartic, tonic, diuretic, dye.

Genera: **1. Cassia (Cathartocarpus). 2. Copaiba.**

SENNA. SENNA.

Cassia {**acutifolia**, *Delile*,
angustifolia, *Vahl.*} {The dried leaflets, with not more than 10 p. c. of stem tissues, pods, seeds, foreign matter.

Habitat. E. and C. Africa, India.

Syn. Senn.; Br. Sennæ Folia, Senna Leaves: 1. Senna Alexandrina, Alexandrian (Nubian, Tripoli) Senna; Fr. Séné—d'Alexandrie; Ger. Alexandrinische Senna. 2. Senna Indica, East Indian (Arabian, Bombay, Mecca, Mocha, Tinnevelly) Senna; Fr. Séné de l'Inde—de Tinnevelly, Feuilles de Séné; Ger. Folia Sennæ, Sennesblätter, Indische Senna.

A-cu-ti-fo'li-a. L. *acutus*, sharp, + *folium*, leaf—*i. e.*, leaves sharp pointed.

An-gus-ti-fo'li-a. L. *angustus*, narrow, + *folium*, leaf—*i. e.*, leaves narrow.

Sen'na. L. fr. Ar. *sana, sena.* Hind. *sena*—*i. e.*, native Arabian plant name; this is the subgenus of *Cassia*, but should have held full generic rank.

PLANTS.—*Cassia acutifolia*, small shrub, .6–1 M. (2–3°) high; stem erect, woody, branching, whitish; flowers large, yellow, axillary raceme; fruit few, legume, 5 Cm. (2′) long, 18 Mm. ($\frac{3}{4}$′) broad, thin, broadly elliptical, reniform, dark green, membranous, smooth, indehiscent, 6–7-celled, each with a cordate, ash-colored seed; leaves alternate, 4–5 pairs, paripinnate, footstalks glandless, 2 small-pointed stipules at base; *Cassia angustifolia*, small shrub similar to preceding, except fruit a trifle longer and narrower, 8-seeded; leaves sessile, 5–8 pairs. LEAFLETS (*C. acutifolia*): *Alexandria*, 2–3.5 Cm. ($\frac{4}{5}$–$1\frac{2}{5}$′) long, 6–10 Mm. ($\frac{1}{4}$–$\frac{2}{5}$′) broad, inequilaterally lanceolate, lance-ovate, short, stout petiolule, acutely cuspidate, entire, subcoriaceous, brittle, pale green, sparsely and obscurely hairy, especially beneath, hairs appressed; usually unbroken, occasionally in fragments; odor characteristic;

taste somewhat mucilaginous, bitter; (*C. angustifolia*): *India*, 2–5 Cm. ($\frac{4}{5}$–2′) long, 6–14 Mm. ($\frac{1}{4}$–$\frac{3}{5}$′) broad, yellowish-green, smooth above, paler beneath, more abruptly pointed than, but odor and taste resembling closely, the preceding. Powder, light green; microscopically—conical, 1-celled, non-glandular, hairs, rosette aggregates of calcium oxalate, 4–6-sided prisms, stomata broadly elliptical (*C. angustifolia* slightly darker green and fewer hairs). *Tests:* 1. Boil for 2 minutes .5 Gm. with alcoholic solution of potassium hydroxide (1 in 10) 10 Ml. (Cc.), add water 10 Ml. (Cc.), acidify filtrate with hydrochloric acid, shake with ether, and the ethereal layer with ammonia water 5 Ml. (Cc.)—latter pinkish-, bluish-red color. *Solvents:* water or diluted alcohol extracts the active constituents (*emodin, chrysophanic acid*); water-soluble constituents 28 p. c.; a decoction made by long boiling is inert, being rendered more so by the addition of an alkali or acid; leaves by percolation with alcohol are deprived of their griping

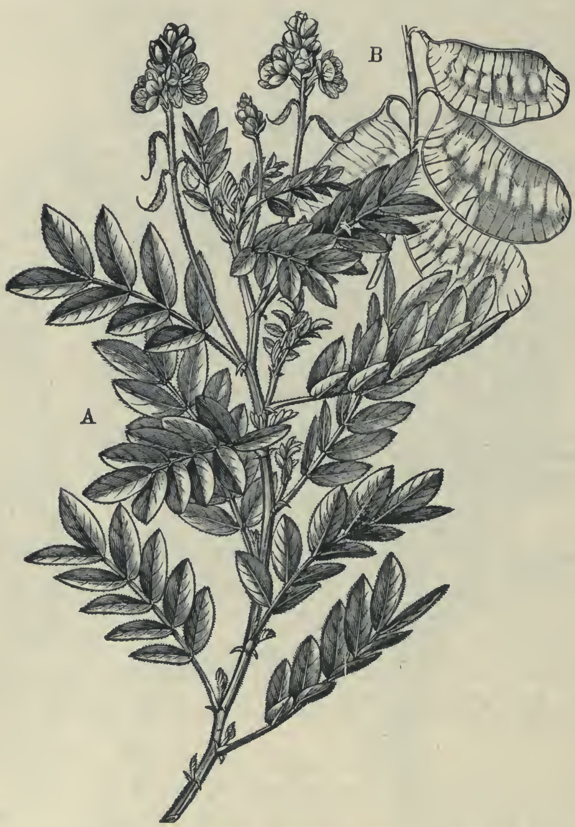


Fig. 177.—*Cassia acutifolia:* half natural size; *A*, leaflets; *B*, legumes.

(resinous) content, odor, taste, and color, but still retain their pleasant cathartic power, this, however, being slightly lessened. Dose, ʒss–3 (2–12 Gm.).

ADULTERATIONS.—*Alexandria:* 1. *C. obovata,* leaflets, called by Arabs *Senna Baladi* (Wild Senna), and considered in Egypt less valuable than *Senna Jebeli* (Mountain Senna, *C. acutifolia*). 2. *Solenostemma Argel,* leaves which have lateral veins indistinct, leathery, wrinkled, bitter; flower buds present; fruit pear-shaped. 3. *Crac'ca* (*Tephro'sia*) *Apollin'ea,* leaflets, S. Europe, uneven base, obovate, emarginate (poisonous). 4. *Coria'ria myrtifo'lia,* leaves (poisonous), and *Colu'tea arbores'cens,* leaflets formerly used. 5. Leaves of *Ailan'thus glandulo'sa, Tree of Heaven,* easily recognized, even in the powder. 6. *Pods, leaf-stalks, branches.* All these now are garbled out carefully. The Arabians preferred the pods, as they contain 25 p. c. more cathartic principle than the leaflets, and no resin or volatile oil, hence do not gripe. Six or eight pods infused in ℥ij (60 Ml. (Cc.)) of water will purge an adult.

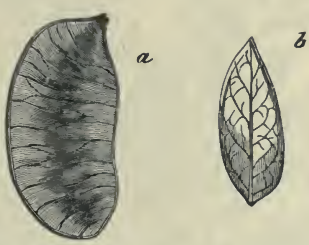


FIG. 178.—*Cassia acutifolia: a,* legume; *b,* leaflet, about natural size.

Commercial.—Plants yield two annual crops of leaflets, the larger (best) in September, at the end of the rains, the smaller in April, during the dry season; the entire plants are cut down (by natives), exposed on rocks to the hot sun until dry, stripped of leaflets, which are packed in palm-leaf bags for transportation on camels to the market ports, where, after being garbled, the drug is put into large bales for exportation. There are several varieties: 1, *Alexandrian* (*Nubian*), chiefly from Nubia (Sennaar, Kordofan), some from Timbuctoo, being forwarded usually via Assouan, Darao, thence by the Nile to Cairo and Alexandria; its botanic source has received various synonyms: *Cassia acutifolia, C. lanceola'ta, C. leniti'va, C. officinalis, C. æthio'pica, C. orientalis,* etc.; *Tripoli senna,* from Tripoli (interior Africa), having no doubt the same botanic origin, is conveyed to market ports by caravans, being, as a rule, much broken, discolored, and mixed with legumes, stalks, and earthy matter, but no foreign leaves, and seldom reaches our country; it is restricted by some to *C. æthiopica* (*C. obovata, C. ova'ta*), and is not grown in Arabia or India. 2, *Indian* (*Arabian, Mocha, Tinnevelly*), originally indigenous to S. Arabia and interior of Africa, but entered market via India (Bombay, Calcutta); its botanic source has received several synonyms: *Cassia angustifolia,* *C. elonga'ta, C. med'ica;* now cultivated extensively, from Arabian seeds, at Tinnevelly, S. India, where it becomes most luxuriant; and owing to freedom from legumes, stalks, etc., furnishes the finest and purest leaflets; it is exported mostly from Tuticorin, and Madras; *Bombay* (*E. India*) *Senna,* sold frequently as Tinnevelly, has the same source, but is dried less carefully, often containing small and discolored leaflets; *Arabian* (*Mecca*) *Senna,* sold often as Bombay, is collected and dried even with less care, and contains many brown leaflets and legumes.

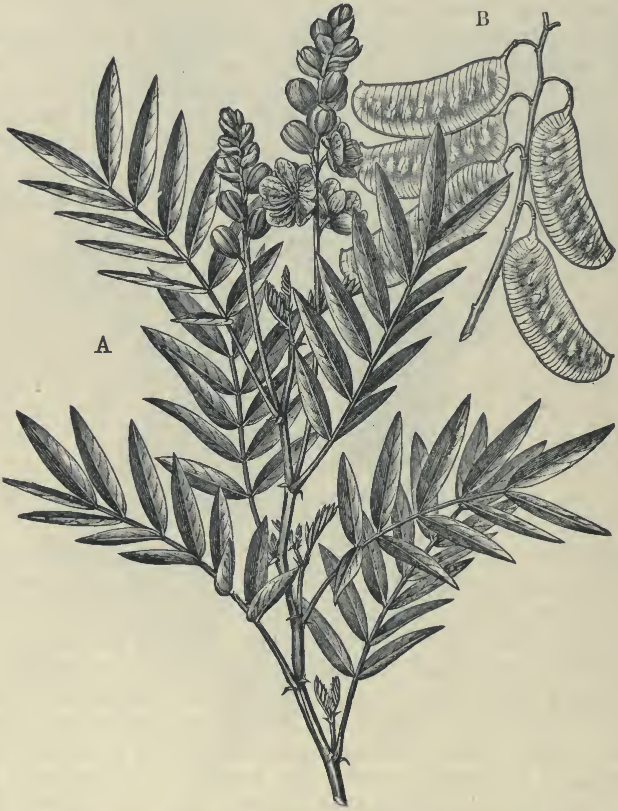


Fig. 179.—*Cassia angustifolia:* half natural size; *A*, leaflets; *B*, legumes.

Constituents.—Anthraglucosennin, Emodin 1 p. c., Chrysophanic acid, Glucosennin, Isoemodin, Senna-rhamnetin, Sennanigrin, gum, resin, catharto-mannite (non-fermentable sugar), isomeric with quercite, sennapicrin, oxalic, malic, tartaric acids, combined with calcium, volatile oil (developing after drying), ash 10–12 p. c., of which 3 p. c. is insoluble in hydrochloric acid.

Anthraglucosennin.—Obtained (Tschirch) by evaporating a weak ammoniacal percolate of senna; it is a complex brownish-black powder, partly soluble in ether, acetone, capable of being resolved into components by various solvents; the ether-soluble portion (emodin, chrysophanic acid, glucosennin) when boiled with toluene, to a partial solution, and poured into benzin gives a precipitate—(*senna-*)*emodin*—trioxymethylanthraquinone, melting at 223° C. (434° F.), while in the benzin mother-liquor remains—(*senna-*)*chrysophanic acid*—dioxymethylanthraquinone, obtained by evaporation; the ether-soluble portion insoluble in toluene is an emodin glucoside—*glucosennin*, $C_{22}H_{18}O_8$ (yellow amorphous powder). The ether-insoluble portion (isoemodin, senna-rhamnetin) when treated with acetone and shaken with benzin yields—(*senna-*)*isoemodin*, $C_{15}H_{10}O_5$ (isomeric with (senna-)emodin, but differs in being soluble in benzin); the acetone solution retains—*senna-rhamnetin* (reddish-brown powder, differing from rhamnetin in not fluorescing in sulphuric acid solution); the anthraglucosennin residue left after treatment with ether and acetone is a black, amorphous powder, which treated with alcoholic potash yields—(senna-)emodin and (senna-)chrysophanic acid. From an aqueous percolate Tschirch extracted cathartic acid and a crystalline body, $C_{14}H_{10}O_5$, having similar reactions as sennanigrin, but concludes that the cathartic action (peristalsis) is due solely to the emodin and chrysophanic acid, both being oxymethylanthraquinones. Formerly senna was believed to contain: cathartic (cathartinic) acid, sennapicrin, sennacrol (resin causing griping), chrysophan and phæretin (yellow coloring matters), sennite (cathartomannite), mucilage, ash 10–12 p. c.

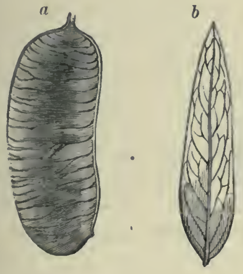


Fig. 180.—*Cassia angustifolia: a*, legume; *b*, leaflet, about natural size.

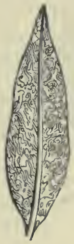


Fig. 181.—Argel leaf.

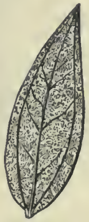


Fig. 182.—Coriaria leaf.

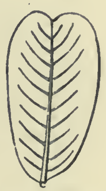


Fig. 183.—Cracca (Tephrosia) leaflet.

Preparations.—1. *Fluidextractum Sennæ.* Fluidextract of Senna. (Syn., Fldext. Senn., Fluid Extract of Senna; Liquor Sennæ Concentratus; Fr. Extrait fluide de Séné; Ger. Sennafluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: 33 p. c. alcohol, reserving first 80 Ml. (Cc.). Dose, ʒss–2 (2–8 Ml. (Cc.)).

Preps.: 1. *Syrupus Sennæ.* Syrup of Senna. (Syn., Syr. Senn.; Fr. Sirop de Séné; Ger. Sirupus Sennæ, Sennasirup.)

Manufacture: 25 p. c. Mix oil of coriander .5 Ml. (Cc.) with fluidextract of senna 25 Ml. (Cc.), add syrup q. s. 100 Ml. (Cc.), mix thoroughly. Dose, ʒss–4 (2–15 Ml. (Cc.)).

2. *Syrupus Sarsaparillæ Compositus,* 1.5 p. c. (fluidextract of senna).

2. *Infusum Sennæ Compositum.* Compound Infusion of Senna. (Syn., Inf. Senn. Co., Black Draught; Br. Mistura Sennæ Composita; Fr. Tisane de Séné composé; Ger. Wiener Trank, Sennaaufguss.)

Manufacture: 6 p. c. Macerate for half an hour senna 6 Gm., manna 12, fennel 2, in boiling water 80 Ml. (Cc.), strain, express, dissolve in the infusion magnesium sulphate 12 Gm., strain, pass through residue on strainer water q. s. 100 Ml. (Cc.); must be dispensed only when fresh. Dose, ℥j–3 (30–90 Ml. (Cc.)).

3. *Pulvis Glycyrrhizæ Compositus,* 18 p. c.

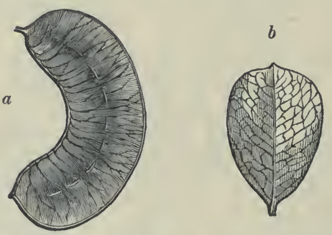


FIG. 184.—*Cassia obovata: a,* legume; *b,* leaflet, about natural size.

Unoff. Preps.: Confection, 10 p. c. (+ cassia fistula 16, tamarind 10, prune 7, fig 12, water 65, strain, add sugar 55.5, evaporate to 89.5, add senna 10, coriander oil .5), dose, ʒj–2 (4–8 Gm.)). *Extract,* dose, gr. 5–20 (.3–1.3 Gm.). *Infusum Sennæ* (Br.), 10 p. c. + ginger .5. *Aromatic Syrup,* 12.5 p. c., +. *Compound Syrup,* 13.5 p. c., +. *Tinctura Sennæ Composita* (Br.), 20 p. c. *Species Laxativæ, St. Germain Tea,* 40 p. c., + sambucus 25, fennel 12.5, anise 12.5, potassium bitartrate 10.

PROPERTIES.—Cathartic, acts on nearly the entire intestinal tract (especially colon), increasing peristalsis and intestinal secretion, except biliary; produces in 4 to 6 hours copious yellow stools, with griping and flatulence; does not cause hypercatharsis nor constipation. Large dose vomits, purges, with severe tenesmus, but never poisons; the odor acts as a cathartic on very susceptible persons.

USES.—Arabians used it in skin affections; now employed for habitual constipation, hemorrhoids, fissura ani, fevers. Its smell, taste, tendency to nauseate, injurious effects in hemorrhoids, intestinal hemorrhage, and inflammation, all lessen its popularity; its purgative action is increased by bitters, calumba, etc., while the griping and nausea are diminished by coriander, tamarind, manna, fennel, Epsom or Rochelle salt. If leaves be macerated long in water, or if the mass be pressed tightly, much acrid, resinous principle will be obtained, causing griping, hence should exhaust by rapid percolation.

Allied Plants:

1. *Cassia obova'ta.*—Leaflets, official 1830–1870. This was the first senna known, being introduced by the Moors into Europe as early as the 9th century, where even in the 16th it became very largely cultivated. Grows wild on sandy soil in Egypt, Nubia, Abyssinia, Tripoli, Senegal, Arabia, India; cultivated in Jamaica, being called *Port Royal* or *Jamaica Senna;* leaves 5–7 pairs, leaflets obovate, obtuse. *C. pubes'cens* (*C. holoseric'ea*), *Aden Senna,* Abyssinia, rarely met with now; leaflets 2.5 Cm. (1′) long, ovate, mucronate, hairy, sometimes mixed with Mecca senna. *C. brev'ipes,* C. America; leaflets resemble Indian senna, but have 3 longitudinal veins; infusion non-purgative.

2. *C. marylan'dica.*—Leaflets, official 1820–1880; United States, New England to S. Carolina, west to the Mississippi. Plant 1–1.5 M. (3–5°) high; leaves alternate, leaflets paripinnate, 8 pairs, 2.5–5 Cm. (1–2′) long, 12 Mm. ($\frac{1}{2}$′) wide; flowers August, yellow; fruit pod, 7.5 Cm. (3′) long; in sandy soil, river banks, introduced into England in 1723, cultivated for ornament, collected Aug.–Sept.; contains cathartic acid, volatile oil, and is given in one-third larger doses than the official varieties; in infusion.

3. *C. Fis'tula, Purging Cassia.*—The dried fruit, official 1820–1910; E. India, Egypt, nat. in S. America, W. Indies. Handsome tree, 9–15 M. (30–50°) high; bark gray; leaves paripinnate, leaflets 3–7 pairs, 5–15 Cm. (2–6′) long, ovate; flowers yellow. Fruit cylindrical, 25–50 Cm. (10–20′) long, 20 Mm. ($\frac{4}{5}$′) thick, blackish, longitudinal groove (ventral), slight ridge (dorsal), indicating the 2 sutures, indehiscent, 25–100 transverse compartments, each with a brown seed, 8 Mm. ($\frac{1}{3}$′) long, embedded in blackish-brown pulp (30 p. c.) having prune-like odor, mawkish sweet taste; contains (pulp) sugar 60 p. c., mucilage, pectin, albuminoids, tannin, volatile oil, butyric acid, calcium oxalate. Laxative; costiveness, to promote bile flow; usually combined with other drugs (manna, tamarind, salines, etc.). Dose, ʒj–2 (4–8 Gm.).

4. *Dip'teryx odora'ta, Tonka Bean;* Guiana. Large tree, fruit oblong-ovate, single-seeded; seed used in medicine, 4 Cm. (1$\frac{3}{5}$′) long, compressed, rounded at each end, testa dark brown, thin, wrinkled, somewhat glossy, often covered with small white crystals of coumarin; kernel light brown; oily; odor agreeably aromatic, resembling vanilla; taste bitter, aromatic; contains coumarin (coumarinum), $C_9H_6O_2$—anhydride of ortho-oxycinnamic acid (also prepared synthetically), the odorous principle in sublimable crystals, fixed oil 25 p. c., sugar, mucilage. There are two varieties: 1, Dutch; 2, English. Narcotic, stimulant, paralyzant to the heart; whooping-cough (fluidextract), as a flavoring ingredient—cigars, sachets, etc. Dose, gr. 5–10 (.3–.6 Gm.).

5. *Melilo'tus officina'lis* and *Melilotus altis'simus, Sweet Clover.* The leaves and flowering tops; Europe, United States. Plants 1–1.5 M. (3–5°) high, flowers yellow and white, in racemes on angular stems; leaves serrate, trifoliate; odor fragrant, honey-like, especially when in bloom, which becomes stronger and more agreeable upon drying,

resembling tonka bean; taste aromatic, bitter; contains coumarin (chief constituent of tonka bean), melilotic acid, coumaric acid, melilotol (fragrant volatile oil). Used mostly locally to allay pain in abdomen, joints, etc., plasters, ointments, infusion, decoction.

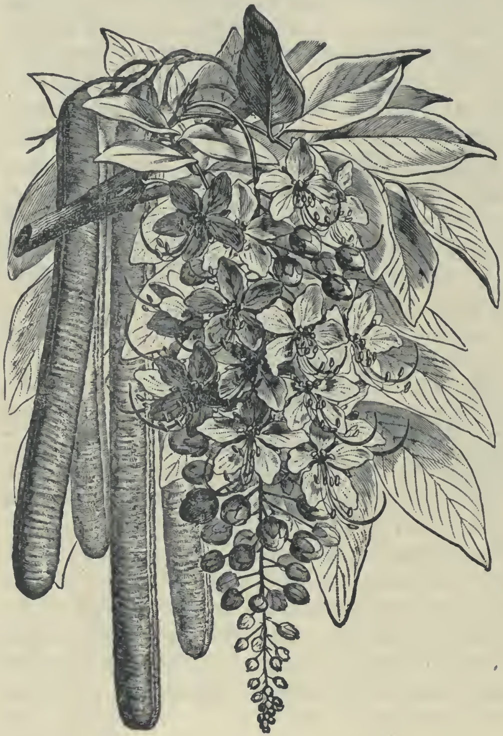


FIG. 185.—*Cassia Fistula.*

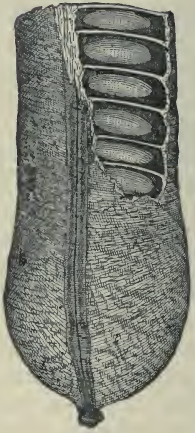


FIG. 186.—*Cassia Fistula:* Part of pod, natural size.

6. *Trigonel'la Fœn'um-grœ'cum, Fenugreek.* The seeds; India, Europe; cultivated in France, Germany, etc. Annual herb, .3 M. (1°) high, leaves trifoliate, leaflets dentate, flowers yellowish, fruit compressed legume containing 16 seeds; seeds 3 Mm. ($\frac{1}{8}'$) long and broad, 2 Mm. ($\frac{1}{12}'$) thick, rhombic, flattened, brownish-yellow, large diagonal groove; strong aromatic, to some pleasant, odor; taste mucilaginous, bitter; contains volatile oil, fixed oil 6 p. c., mucilage 28 p. c., proteids 22 p. c., bitter principle, choline, trigonelline .13 p. c. Powder sometimes adulterated with ground amylaceous seeds. Used similar to flaxseed, elm, althæa; emollient cataplasms, enemata, ointments, plasters, decoction, 5 p. c. (usually thick and slimy); demulcent in veterinary condition-powders.

7. *Trifo'lium praten'se, Red Clover, Trifolium re'pens, White Clover.* —The dried inflorescence—used as alterative, deobstruent; sedative; whooping-cough, spasmodic affections; infusion.

COPAIBA. COPAIBA.

Copaiba, *Miller,* one or more species. } An oleoresin.

Habitat. Brazil (Venezuela, Colombia), Amazon valley, banks of the Orinoco River.

Syn. Copaib., Balsam of Copaiba, Copaiva, Balsam Capivi; Fr. Copahu, Oleo-résine (Baume) de Copahu; Ger. Balsamum Copaivæ, Copaivabalsam.

Co-pai'ba. L., Sp., and Port., fr. Brazil. *cupauba*—*i. e.*, native name of the tree and its product.

Plant.—Handsome tree, 4.5–18 M. (15–60°) high, much branched, bark brown, rather smooth; leaves alternate, paripinnate; leaflets opposite, 3–5 pairs, 2.5–5 Cm. (1–2′) long, ovate, entire, glabrous, coriaceous, pellucid-punctate; flowers small, white; sepals 5; apetalous; stamens 10; pod small, 2.5 Cm. (1′) long, orange-brown, dehiscent into 2 valves, 1-seeded. Oleoresin (copaiba), pale yellow, brownish-yellow, viscid liquid, without fluorescence or with only slightly greenish fluorescence; odor peculiar, aromatic; taste bitter, acrid; soluble in chloroform, ether, petroleum benzin (1), any addition producing a flocculent precipitate, partly soluble in alcohol, soluble, showing not more than slight opalescence in dehydrated alcohol, carbon disulphide, fixed or volatile oils; insoluble in water; sp. gr. 0.940–0.995. *Tests:* 1. Heat on water-bath—no odor of oil of turpentine, and residual resin should be hard, brittle, and weigh 36 p. c. of original copaiba taken (abs. of oil of turpentine, paraffin, fatty oils). 2. Dissolve 3–4 drops of oil of copaiba in 3 Ml. (Cc.) of glacial acetic acid, mix with a drop of fresh aqueous solution of sodium nitrite (1 in 10), carefully underlay this with 2 Ml. (Cc.) of sulphuric acid—acetic layer not pink (abs. of gurjun balsam). 3. Shake 5 Ml. (Cc.) with 15 Ml. (Cc.) of alcohol, boil 1 minute—no oil separates after cooling (abs. of paraffin oils). Dose, ♏x–60 (.6–4 Ml. (Cc.)).

Adulterations.—Oleoresin: Those of allied species, that partially deprived of oil, oil of turpentine, volatile oils, rosin, rosin oil, paraffin, paraffin oils, fatty oils (linseed, castor, etc.), Venice turpentine, gurjun balsam, alcohol—often evinced through different odors on slowly heating. Oil: Gurjun balsam oil, increasing specific gravity, African copaiba oil—insoluble in equal volume of alcohol.

Commercial.—Much was written concerning copaiba during 1625–1638, but Marcgrav and Piso first described its collection, also the tree, 1648; Jacquin studied the genus, 1760, as did Desfontaines some years later, while Hayne, 1827, Bentham, 1870, Baillon, 1877, separated by the varying foliage 11 species in Brazil alone, all having similar flowers, fruit, and valuable, hard, strong, tough, durable wood. However, most of copaiba comes from 7 species: Brazil—*C. Langsdorf'fii, C. confertiflo'ra, C. coria'cea, C. oblongifo'lia;* N. W. Orinoco

Valley—*C. officina'lis;* Amazonian region—*C. guianen'sis, C. multiju'ga.* It is a pathogenic product, possibly an antiseptic protective, occurring in schizogenic ducts (cavities differing greatly in size), from which it is obtained by making large auger holes or boxes, square or wedge-shape, into the centre of the tree, near the base, whence it usually flows at once, demanding alertness to avoid loss, often giving 12 pounds (5.5 Kg.) in 3 hours; if none should appear the aperture is closed with clay or wax and reopened in 2 weeks, when, as a rule, the discharge is abundant. The flow at first is thin, clear, colorless, but soon becomes thicker and yellowish, as it does also with age. A tree may yield 10–12 gallons (38–45 L.), in 2–3 annual flows, and when abandoned, the ducts, some the length of the stem, occasionally fill and, acting as high liquid columns, furnish sufficient pressure to burst the trunk with a cannon-like report. It is exported in casks, demijohns, cans, jugs, the value depending upon the amount of contained volatile oil. There are several varieties: 1, *Para,* most limpid, palest; contains

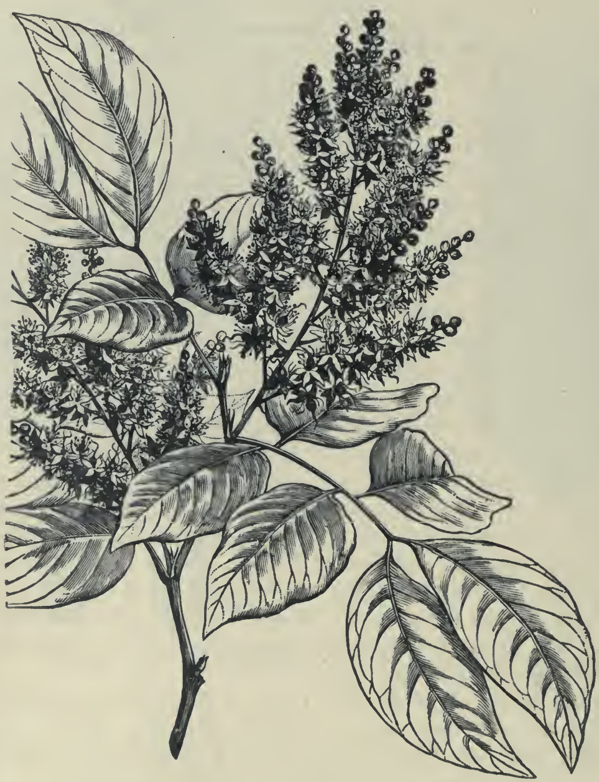


FIG. 187.—*Copaiba Langsdorffii.*

volatile oil 60–90 p. c.; 2, *Maranham*, denser, consistence of olive oil, odor slightly different; contains volatile oil 40–60 (rarely 80) p. c.; 3, *Rio Janeiro*, resembles closely the Maranham—these three (Brazilian) form clear mixtures with one-third to one-half their weight of ammonia water, but milky if more alkali or fixed oil present; 4, *Surinam* (*C. guianensis*), rather thin, light yellow, soluble in ether, chloroform, alcohol (4–5 parts, turbid with equal portion), violet with bromine (1) + chloroform (20); contains volatile oil 70–80 p. c.; 5, *Maracaibo*, the thickest, turbid, dark yellow; solidifies with magnesium oxide, not clear with ammonia water; contains volatile oil 20–40 p. c., and owing to large amount of resin is well adapted for once official Massa Copaibæ, as it combines with magnesium oxide forming resin soap, which gradually becomes dry and hard; Para and other varieties may be used but sufficient volatile oil must be evaporated to render residue viscid upon cooling. Copaiba is exported not only from the above ports, but also from Angostura, Cayenne, W. Indies, Trinidad, C. America, etc.

Constituents.—Volatile oil, Resin, bitter principle, copaivic acid, $C_{20}H_{32}O_2$ (oxycopaivic acid, $C_{20}H_{28}O_3$, from Para, metacopaivic acid, $C_{22}H_{34}O_4$, from Maracaibo—all three acids crystalline). Has no benzoic or cinnamic acid, hence the name balsam is misapplied.

Oleum Copaibæ. Oil of Copaiba, $C_{15}H_{24}$.—This volatile oil is distilled from copaiba with water or steam, and upon it most of the medicinal properties of the oleoresin depend. It is a pale yellowish liquid, oxidizing by exposure, characteristic odor of copaiba, aromatic, bitter, pungent taste; consists chiefly of caryophyllene, $C_{15}H_{24}$; sp. gr. 0.900, increasing with age; soluble in 2 volumes alcohol; that from Maracaibo dark blue with hydrochloric acid gas. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏v–15 (.3–1 Ml. (Cc.)), in emulsion, capsule, or on sugar.

Resina Copaibæ. Resin of Copaiba.—(Acidum Copaibicum). The residue left after distilling off the volatile oil from copaiba. It is brownish-yellow, brittle, slight odor and taste of copaiba, to which the resin returns when mixed with the volatile oil of copaiba; soluble in alcohol, ether, chloroform, benzene, volatile oils; contains copaivic, or metacopaivic acid, mixed with neutral resin. Dose, gr. 5–15 (.3–1 Gm.).

Preparations.—(Unoff.) *Massa Copaibæ*, 94 p. c. + magnesium oxide 6 p. c. *Mixture*, 12.5 p. c., +. *Mixture with Opium*, 25 p. c., +. *Capsules. Emulsion. Electuary. Pills. Suppositories.*

Properties.—Similar to turpentine; diuretic, stimulant, expectorant, laxative, nauseant, disinfectant; acts mainly on the mucous membranes (genito-urinary), by which, and also skin, it is eliminated; increases quantity as well as solids of the urine, and imparts odor to urine, sweat, milk, breath; sometimes erupts the skin—roseola, urticaria, etc.

Uses.—Gonorrhœa, cystitis, bronchitis, dysentery, diarrhœa, hemorrhoids, psoriasis, dropsy, leprosy; volatile oil is not so valuable for gonorrhœa, gleet, etc., as the oleoresin, but better for throat affections. Externally—chilblains, sore nipples, anal fissures. often added to varnishes and *vice versa.* Long usage may cause indigestion and renal irritation.

Poisoning, Incompatibles, Synergists: Same as for turpentine.

Allied Products:

1. *Copaiba Mar'tii, C. cordifo'lia, C. Jus'sieui, C. Jac'quini, C. nit'ida*—all furnish oleoresin, usually poor in the amount of volatile oil.

2. *Hardwick'ia pinna'ta.*—E. India. Tree yields dark brown oleoresin, containing volatile oil 20–40 p. c., resin, no copaivic acid.

3. *Dipterocar'pus ala'tus.*—India. Tree yields gurjun balsam or wood oil—an oleoresin resembling copaiba, containing gurjunic (metacopaivic) acid.

4. *Copal, Gum Copal.*—A fossil resin of Zanzibar or exuding from many leguminous plants of Africa, S. America, W. Indies. Occurs in yellowish-brown masses, wrinkled surface, conchoidal fracture, glossy, odorless, tasteless; when melted becomes soluble in alcohol, ether, and oil of turpentine. Same medicinal properties as copaiba, only weaker; used mainly in preparing varnishes.

Allied Plants:

1. *Tamarin'dus in'dica, Tamarind.*—The preserved pulp of the fruit, official 1820–1910; India, Africa, nat. in W. Indies. Handsome tree, 18–24 M. (60–80°) high; bark rough, ash color; leaves paripinnate, leaflets 8–16 pairs, sessile, 12–25 Mm. ($\frac{1}{2}$–1′) long, 6 Mm. ($\frac{1}{4}$′) broad; flowers yellow, racemes; fruit indehiscent legume, compressed, 7.5–15 Cm. (3–6′) long, 2.5 Cm. (1′) broad, curved, nearly smooth, yellowish-brown, pericarp thin, brittle, corky, Pulp reddish-brown, darker with age, including branched-fibres and 3–10 reddish-brown, smooth seeds, each enclosed in a tough membrane; odor distinct; taste sweet, agreeably acid. Bright iron in contact with moist pulp 30 minutes should not show reddish deposit (abs. of copper from evaporating vessels). There are three varieties: 1, W. Indian (Brown, Red), the once official kind, cakes kneaded with sugar or hot syrup, or alternate layers of pulp and sugar; 2, E. Indian (Black), masses simply pressed together and dried in the sun; 3, Egyptian, cakes, flat, round, black, acrid, often moldy; contains tartaric acid 5–9 p. c., citric acid 4–6 p. c., potassium bitartrate 5–6 p. c., malic acid, acetic acid (mostly as potassium salts), sugar, pectin, tannin (in seed testa), insoluble matter 12–20 p. c. Laxative, refrigerant; febrile diseases, combined with other laxatives (senna, etc.) as a flavoring. Dose, ʒss–5 (2–20 Gm.).

2. *Hæmatox'ylon campechia'num, Hematoxylon, Logwood.*—The heartwood, official 1820–1910; C. America, nat. in W. Indies. Spreading tree, 7.5–12 M. (25–40°) high, .3–.6 M. (1–2°) thick, knotty, tough; bark dark, rough, white dotted; leaves paripinnate, leaflets 4–5 pairs, obcordate, smooth; flowers yellow, racemes, jonquil odor; fruit legume, 2.5–4 Cm. (1–1$\frac{3}{5}$′) long, compressed, tapering ends, 2-seeded. Heartwood in logs 1 M. (3°) long, 15 Cm. (6′) thick, sp. gr. 1.06, hard purplish-black, internally brownish-red, irregular concentric circles, medullary rays 4 cells wide; odor faint, agreeable; taste sweetish, astringent; colors saliva dark pink. In shops as small chips,

coarse powder, brownish-red, often with a greenish lustre (fermentation or oxidation of hæmatoxylin into hæmatein by ammonia in the air), which pieces should be rejected. Imparts yellowish color to slightly acidified water, changed to purple by alkalies (red with Brazil wood, no change with red saunders); solvents: boiling water, alcohol. There are four varieties: 1, Campeachy; 2, Honduras; 3, St. Domingo; 4, Jamaica. Contains hæmatoxylin 12 p. c., volatile oil, tannin, fat, resin. Astringent, tonic, antiseptic, similar to tannin; cholera infantum, chronic diarrhœa, dysentery, leucorrhœa, hemorrhage, dyspepsia; antiseptic in gangrene, ulcers, cancer; chiefly in dyeing violet, blue, gray, black. Dose, ʒss–1 (2–4 Gm.); extract (water), gr. 5–15 (.3–1 Gm.).

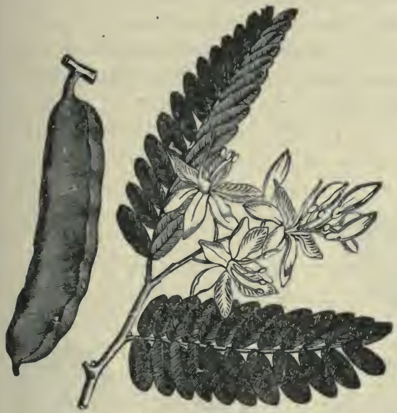


FIG. 188.—*Tamarindus indica.*

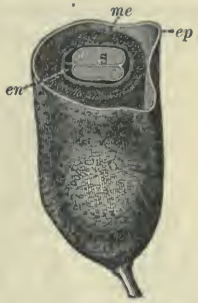


FIG. 189. — Tamarind fruit: cross-section: *ep*, epicarp; *me*, mesocarp; *en*, endocarp; *s*, seed.

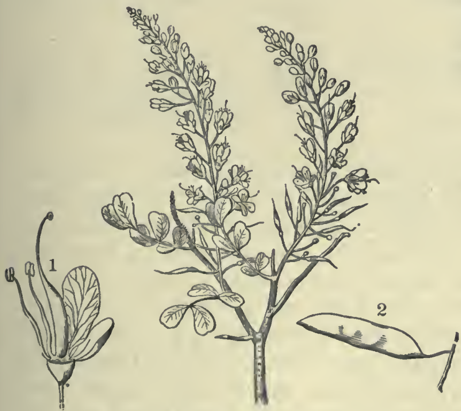


FIG. 190.—*Hæmatoxylon campechianum: 1*, flower; *2*, fruit.

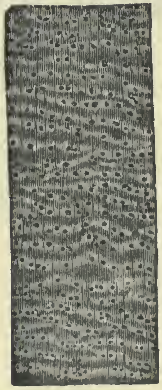


FIG. 191.—Lignum campechianum; cross-section, magnified 4 diam.

3. *Erythrophlœ'um guineen'se, Sassy, Mancona,* or *Ordeal Bark.*—The dried bark; W. and C. Africa. Large tree with spreading branches, doubly pinnated leaves. Bark flat or curved, 5 Mm. ($\frac{1}{5}'$) thick, warty, fissured, hard, dull red with whitish spots, brittle, transverse cut shows fawn-colored spots, inodorous, astringent; contains erythrophlœine (heart tonic, anæsthetic, poisonous), manconine, tannin. Cardiac tonic, local anæsthetic, astringent, diaphoretic, narcotic, sternutatory; occasions slow, strong pulse. Dose of erythrophlœine hydrochloride, gr. $\frac{1}{32}$–$\frac{1}{16}$ (.002–.004 Gm.).

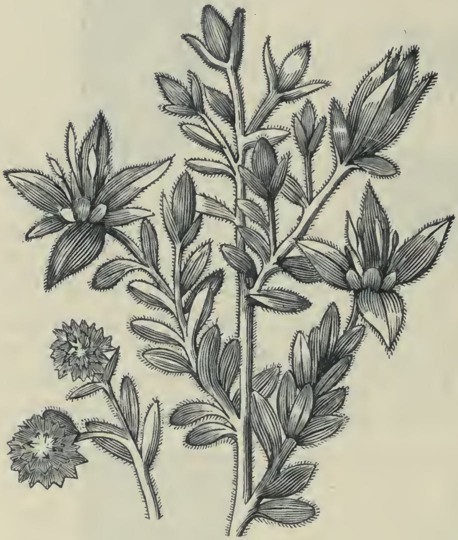


FIG. 192.—*Krameria triandra.*

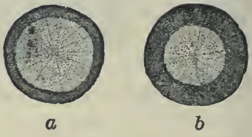


FIG. 193.—Krameria: transverse sections: root; *a*, Peruvian; *b*, Savanilla.

4. *Krame'ria trian'dra, K. Ixi'na, K. argen'tea, Rhatany.*—Krameriaceæ. The dried root, official 1830–1910; S. America, Mexico, sandy, mountainous elevations. Low spreading shrubs; bark grayish-brown, when young hoary with silvery hairs; leaves, covered on both sides with silvery hairs, obovate, entire; flowers red, 4 scarlet sepals, 4 dissimilar, red petals. Roots, branched from short head, woody, 1.5–4 Cm. ($\frac{3}{5}$–1$\frac{3}{5}'$) thick, roughly fissured, supporting a several-headed crown; rootlets 25–50 Cm. (10–20′) long, often 1 Cm. ($\frac{2}{5}'$) thick, wavy, flexible, reddish-brown, purplish-brown, wood paler; bark about one-third the radius; inodorous; taste very astringent; solvents: water, alcohol; contains (mostly in bark) kramero-tannic acid 20 p. c., rhatanic-red, krameric acid, starch, calcium oxalate. There are several varieties: 1, Peruvian (Payta, Red); 2, Savanilla (New Granada, Violet); 3, Para (Brazilian, Brown). Astringent, tonic, similar to tannic acid; chronic diarrhœa, dysentery, hemorrhage, gonorrhœa, ozæna, fissure of anus, nipple; gargle—sore throat, epistaxis, relaxed

uvula, irritated eyes, nose, gums, tooth powder (wash). Dose, gr. 5–30 (.3–2 Gm.); fluidextract (diluted alcohol), ♏v–30 (.3–2 Ml. (Cc.))—syrup, 45 p. c., ʒss–2 (2–8 Ml. (Cc.)); extract (water), gr. 5–10 (.3–.6 Gm.)—troches, 1 gr. (.06 Gm.); tincture, 20 p. c. (dil. alc.), ʒss–2 (2–8 Ml. (Cc.)). *K. cistroi′des*, Chile; roots resemble Peruvian very closely, wood of tap-root pale-reddish in outer layer, brownish-red in the centre. *Guayaquil Rhatany* (origin unknown), root large, contorted, bark thin, fibrous, rich in tannin, reddish-brown, striated, warty. *K. secundiflo′ra* (*lanceola′ta*), *Texas Rhatany;* roots valuable, thin, dark brown, bark thick, rich in tannin; *Florida Rhatany*—same source, and similar to Texas; neither on the market.

35. PAPILIONACEÆ. Pea Family.

Pa-pil-i-o-na′se-e. L. *Papilio-n* + aceæ, butterfly—*i. e.*, alluding to the corolla being butterfly-shaped. Herbs, shrubs, vines, trees. Distinguished by leaves compound, stipulate; flowers papilionaceous, calyx 4–5-toothed, petals perigynous or hypogynous, upper one enclosing the lateral ones in the bud, stamens usually 10; pistil 1, ovary 1-celled; fruit legume or loment, 1–many-seeded; universal; astringent, antispasmodic, demulcent, sedative, dye, poisonous, timber.

Genera: **1. Toluifera. 2. Astragalus. 3. Pterocarpus. 4. Glycyrrhiza. 5. Cytisus. 6. Vouacapoua** (**Andira**). **7. Physostigma.**

BALSAMUM PERUVIANUM. BALSAM OF PERU.

Toluifera Pereiræ,
(Royle) Baillon. } A balsam.

Habitat. Central America (San Salvador), in woods near the coast.

Syn. Bals. Peruv., Peru Balsam, Balsamum Peruvianum Nigrum, Balsamum Indicum, Black Balsam; Fr. Baume—du Pérou,—de Sonsonate,—des Indes; Ger. Perubalsam, Indischer Balsam.

To-lu-if′e-ra. L. *tolu* + *fero, ferre*, to bear, producing tolu or an allied balsam—*i. e.*, it was brought first from Tolu, now Santiago de Tolu in U. S. Colombia.

Per-ei′ræ. L. of Pereira—*i. e.*, in memory of Jonathan Pereira (1804–1853), the author of *Elements of Materia Medica*, and Professor to the British Pharmaceutical Society, who visited S. America to study these and many other plants.

Pe-ru-vi-a′num. L. adj. form, fr. *peruvianus* of or pertaining to Peru—*i. e.*, the secretion.

Plant.—Handsome tree, 15–25 M. (50–80°) high, branching 2.5 M. (8°) above ground; leaves 6–10, alternate, 15–20 Cm. (6–8′) long, imparipinnate; leaflets 5–7.5 Cm. (2–3′) long, oblong-ovate, hairy, puckered margin; flowers 12 Mm. (½′) long, whitish, tomentose, racemes; fruit 1-seeded legume 10 Cm. (4′) long, yellowish-brown. Balsam (of Peru), is a viscid, dark brown liquid, free from stringiness or stickiness, transparent and reddish-brown in thin layers; odor agreeable, vanilla-like; taste bitter, acrid, persistent, burning sensation in the throat when swallowed; does not harden on exposure; soluble in alcohol, chloroform, glacial acetic acid with slight opalescence, partly soluble in ether, petroleum benzin; agitated with water—latter acid to litmus; sp. gr. 1.140. *Tests:* 1. Shake 1 Gm. with hydrated chloral (3) in distilled water (2)—clear solution (abs. of fixed oils). 2. Shake 1 Gm. with purified petroleum benzin (5), warm 10 minutes, replacing loss by evaporation, evaporate 2 Ml. (Cc.)—no turpentine odor, and residue treated with few drops of nitric acid—not green or bluish (abs. of turpentine, rosin). Dose, ♏v–30 (.3–2 Ml. (Cc.)).

Adulterations.—Extract of bark and wood, alcohol, fixed and volatile oils, castor oil, storax, benzoin, gurjun balsam, copaiba, Canada turpentine, rosin, water.

Commercial.—Plants grow wild in forests, either isolated or in groups, occasionally in apparent rows suggesting original planting, but there is no evidence of regular plantations, do not thrive above 300 M. (1,000°) elevation, bear fragrant flowers, and begin yielding balsam at the fifth year, continuing for thirty or more thereafter. Balsam, a pathological product that owes its qualities to neither wood nor bark but to the special treatment of the trees, is collected by the aborigines in a district reserved to them, Sonsonate, Balsam Coast, extending from Acajutla to La Libertad, San Salvador. After the last rains, Nov.–April, the outer cortical portion is scraped from the trunk and stout branches in alternating strips (or squares, 12′; 30 Cm.) an eighth of an inch (3 Mm.) deep, to which are applied burning torches until half-charred and then pieces of raw cotton or old cloth (made to adhere by punching with a machete), which are allowed to remain until saturated, 1–2 days, then collected and boiled in large iron pots, liberating most of the balsam, and finally squeezed in a primitive machine—the product being caught in large bladders, gourds, or wooden bowls, and when cool known as "raw balsam," that may be refined on the spot by a second boiling and straining, or sent to the towns for further purification and packing for market, in screw-top tin canisters, 60 pounds (27 Kg.). As long as the wounds are kept open there usually is some flow, and if the process is conducted carefully the lower ones will heal while the upper and fresher are being worked; when trees have been tapped six consecutive seasons a rest of 2–3 years renders the product more abundant and satisfactory, while a longer period, 5–6 years in every 20, assures a continued yield; each tree averages 2–5 pounds (1–2.5 Kg.) annually. It is exported from Acajutla (Pacific coast) and Belize (Atlantic coast) in jars, metallic canisters, drums, etc. There also is obtained from the fruit by expression a white semi-fluid substance, *Balsamo blanco,* having the odor of Tonka and the appearance of Tolu, but, in spite of containing a crystalline resin, *myroxocarpin,* it is entirely distinct from Tolu or Peru. The natives prepare from the fruit with rum a tincture or alcoholic extract, *Balsamito,* which is used as a stimulant, anthelmintic, diuretic, and externally for indolent ulcers, freckles, etc., while there often exudes from the trees a gum-resin containing 77.4 p. c. of resin, but no aromatic principle or cinnamic acid. Balsam of Peru was considered formerly to be from *Myroxylon peruiferum,* a different tree flourishing in Brazil, Ecuador, Peru, whose product reached Europe via Peru (Callao), hence its name, being a fragrant balsam resembling Tolu and at Rio called *Olea vermelho.*

CONSTITUENTS.—Benzoic acid-benzyl ester, Cinnamein (volatile oil) 56–66 p. c., Resin 16–25 p. c., Cinnamic and Benzoic acids 23 p. c., Vanillin.

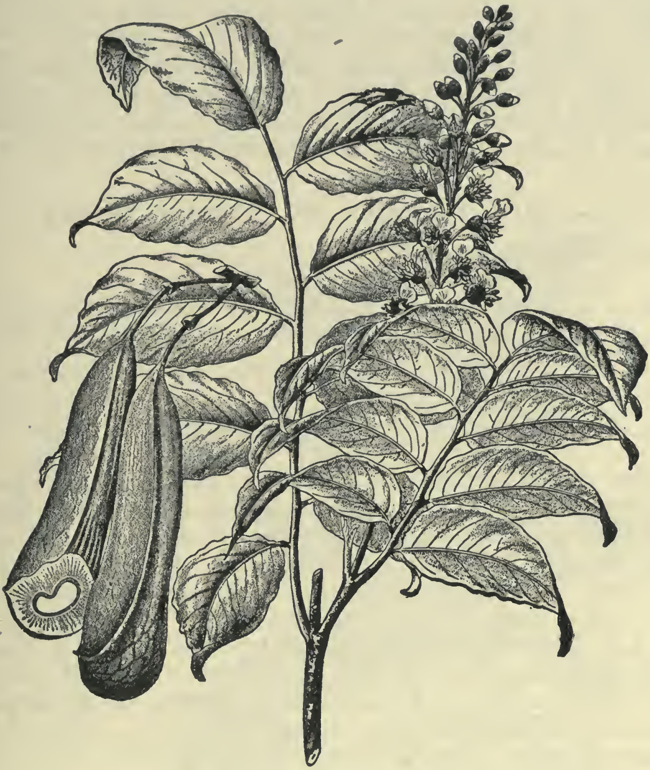


FIG. 194.—*Toluifera Pereiræ.*

Benzoic acid-benzyl ester.—The chief active constituent is a colorless oily liquid, boiling at 173° C. (344° F.), congealing at 32° C. (90° F.), and may readily be made synthetically.

Cinnamein.—Consists largely of benzoic acid-benzyl ester, and to a small extent of cinnamic acid-benzyl ester, both esters being separated easily by fractional distillation in vacuo, and thus obtained pure possess the characteristics, chemical and therapeutical, of the synthetic esters; the cinnamic acid-benzyl ester boils at 213° C. (416° F.), and congeals at 37° C. (99° F.).

Resin.—Consists of peru-resinotannol combined with benzoic and cinnamic acids, soluble in caustic alkali, and when in solution precipitated by carbon dioxide, insoluble in carbon disulphide; on dry distillation yields benzoic acid, styrol, and toluol, C_7H_8.

PREPARATIONS —(Unoff.): *Alcoholic Solution. Capsules. Emulsion. Mistura Oleo-Balsamica*, 1.6 p. c., + eugenol, oils of cinnamon, lavender, lemon, myristica, thyme, each .4, alcohol q. s. 100 (nervine). *Ointment. Syrup.*

PROPERTIES.—Stimulant, expectorant, disinfectant, vulnerary, stomachic. It is eliminated by bronchial mucous membrane, kidneys, and skin, stimulating and disinfecting their secretions.

USES.—Chronic catarrh, asthma, phthisis, gonorrhœa, amenorrhœa, rheumatism, palsy; externally on indolent ulcers, scabies, ringworm, tonsillar diphtheria, bronchitis, tuberculosis of the skin, bone, or larynx, chilblains, eczema, for masking the odor of iodoform in ointment.

BALSAMUM TOLUTANUM. BALSAM OF TOLU.

Toluifera Balsamum, *Linné.* } A balsam.

Habitat. S. America (Venezuela, Colombia, Peru); high rolling countries.

Syn. Bals. Tolu., Tolu Balsam; Fr. Baume—du Tolu—de Carthagène; Ger. Tolubalsam.

Bal'sa-mum. L. fr. Gr. *βάλσαμον*, for balsam, name of balsam tree—*i. e.*, from its characteristic secretion.

Tol-u-ta'num. L. adj. form. fr. *tolutanus*, of or pertaining to Tolu (Santiago de Tolu, Colombia, whence it first entered commerce)—*i. e.*, the secretion.

PLANT.—Evergreen tree 24 M. (80°) high, often branchless for 15 M. (50°) above ground, roundish spreading head; bark smooth, yellowish-brown, with numerous white lenticels; leaves having 4–7 leaflets; flowers upon smooth pedicels, dense racemes, 10–12.5 Cm. (4–5′) long; calyx broadly tubular upon hispid pedicel, mouth 3–4-lobed; anthers versatile; fruit 10–12.5 Cm. (4–5′) long. BALSAM (of Tolu) is a yellowish-brown plastic solid, brittle when old, dried, or exposed to cold, transparent in thin layers; odor pleasant, aromatic, vanilla-like; taste mild, aromatic; soluble in alcohol, chloroform, ether, solutions of fixed alkalies, usually leaving insoluble residue; nearly insoluble in water, petroleum benzin; alcoholic solution acid. *Tests:* 1. Shake 1 Gm. with carbon disulphide (25), let stand 30 minutes, filter, evaporate 15 Ml. (Cc.) to dryness, dissolve residue in glacial acetic acid, + few drops of sulphuric acid—not green; shake remainder of filtrate with equal volume of aqueous solution of copper acetate (1 in 1000)—not green (abs. of rosin, copaiba). Dose, gr. 5–30 (.3–2 Gm.).

ADULTERATIONS.—Turpentine—blackish instead of cherry-red with sulphuric acid, soluble in carbon disulphide; sweet gum—yields styracin to hot benzin, crystallizing when cold; storax, rosin, copaiba, saponifiable substances, various other resins. A factitious balsam has been found containing storax 63 p. c.

Commercial.—Plant resembles *Toluifera Pereiræ* in flowers and fruit but differs from it in having shorter leaves, smaller and fewer leaflets, recurved with non-puckered margin, non-hairy rachis and petiole, and less prominent glands. Balsam—a physiological product in very young tissues, thereafter becoming pathological, possibly an antiseptic protective against depleting local injury—is collected by making V-shaped incisions through the bark and hollowing out the wood below each to support a small calabash cup for catching the flow, there often occurring 20–30 of these from the ground upward (2.5–3 M.; 8–10°), the higher being cut from ladders or scaffolds. Bleeding continues, July–April, at the rate of filling the cups "each moon," they being emptied as occasion demands into rawhide flask-shaped bags (carried by donkeys) which when filled are sent to ports along the Magdalena and Orinoco Rivers where the balsam is transferred to cylindrical tins (10–25 pounds; 4.5–11.5 Kg.), formerly calabashes or baked earthen jars, and as such enters commerce via Carthagena.

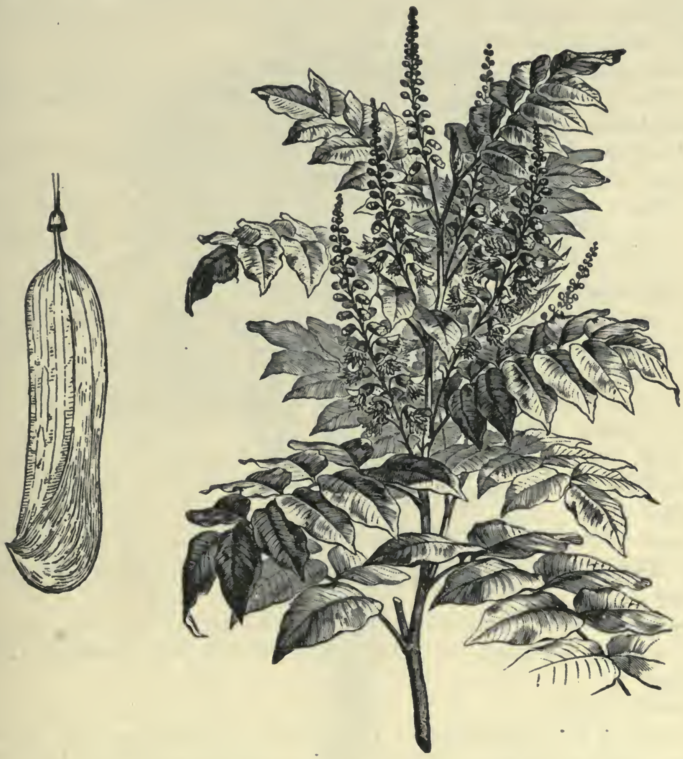


FIG. 195.—*Toluifera Balsamum:* twig one-third natural size, with fruit.

CONSTITUENTS.—Resin 75–80 p. c., Cinnamic and Benzoic acids 18–20 p. c., Volatile oil 1 p. c., Vanillin .5 p. c., benzylic cinnamate and benzylic benzoate, the last two forming an acid, aromatic oily liquid 7.5 p. c.

Resin, $C_{18}H_{20}O_5$.—Chief constituent, consisting of tolu-resinotannol combined with benzoic and cinnamic acids; it is amorphous, black, brittle, similar to that of *T. Pereiræ*, having a portion soluble in carbon disulphide, which upon evaporation yields a crystalline, nearly colorless residue about 25 p. c. of the balsam; a portion of the resin is sparingly, and another readily, soluble in alcohol.

Volatile Oil.—Obtained by distilling with water; chiefly tolene, $C_{10}H_{16}$, hardening by exposure, odor pleasant, sp. gr. 0.858.

Acids.—Obtained by distillation—benzoic, cinnamic, with benzylic ethers of both, the benzyl cinnamate predominating. Trommsdorf found resin 88 p. c., volatile oil .2 p. c., cinnamic acid 12 p. c., this latter coming over as a heavy oil condensing into white crystalline mass. Dry distillation gives the above acids and ethers, also styrol, phenol, toluol—this latter being found in coal tar, wood tar, organic compounds, balsams (Peru, etc.) and resins; it is a colorless, oily liquid, readily convertible into benzoic acid.

Preparations.—1. *Tinctura Tolutana.* Tincture of Tolu. (Syn., Tr. Tolu., Tolu Tincture; Fr. Teinture de Baume de Tolu; Ger. Tolubalsamtinktur.)

Manufacture: 20 p. c. Similar to Tinctura Aloes, page 110; menstruum: alcohol. Dose, ♏x–30 (.6–2 Ml. (Cc.)).

Prep.: 1. *Syrupus Tolutanus.* Syrup of Tolu. (Syn., Syr. Tolu.; Fr. Sirop (balsamique)—de Baume de Tolu; Ger. Tolubalsamsirup.)

Manufacture: 1 p. c. Rub tincture of Tolu 5 Ml. (Cc.) with magnesium carbonate 1 Gm., sugar 6 Gm., gradually add, constantly triturating, water 43 Ml. (Cc.), filter, dissolve in clear filtrate, gently heating, sugar 76 Gm., strain syrup (hot), add water q. s. 100 Ml. (Cc.). Dose, ʒj–4 (4–15 Ml. (Cc.)).

2. *Tinctura Benzoini Composita*, 4 p. c.

Unoff. Preps.: Emulsion. Inhalations. Lozenges.

Properties.—Stimulant, expectorant, disinfectant, vulnerary, stomachic.

Uses.—Much less decided than balsam of Peru, but similar, bronchial affections, diphtheritic deposits, catarrh, coughs, flavoring, perfumery.

Incompatibles: Water and aqueous preparations with the tincture.

Synergists: Balsams, aromatic drugs, volatile oils, stimulant expectorants.

Allied Plants:

1. *Myrox'ylon puncta'tum.*—The *Quino-quino* tree, and *M. peruif'erum,* both of Peru; yield balsams resembling official Peru and Tolu.

2. *Gale'ga officina'lis, European Goat's Rue,* S. Europe.—Small perennial; the dried flowering tops used; stem smooth, 15–45 Cm. (6–8′) long, usually broken; leaves imparipennate, 6–8 pairs, bright green, lanceolate, 2–5 Cm. ($\frac{4}{5}$–2′) long, 2–6 Mm. ($\frac{1}{12}$–$\frac{1}{4}$′) broad, petiolate; flowers small, white, violet, racemes; odor distinct, taste mucilaginous, bitter, astringent. Dose, ʒss–1 (2–4 Gm.); fluidextract (dil. alc.).

PAPILIONACEÆ

TRAGACANTHA. TRAGACANTH.

Astragalus gummifer, *Labillardière,* or other Asiatic species. { The spontaneously dried gummy exudation from the stems.

Habitat. W. Asia—Asia Minor, Armenia, Kurdistan, Persia, Syria, Greece; mountainous districts.

Syn. Trag., Gum Tragacanth, Goat's Thorn Gum, Doctor's Gum, Hog Gum; Fr. Gomme Adragante; Ger. Traganth.

As-trag'a-lus. L. fr. Gr. δστέον, bone, + γάλα, milk—*i. e.*, the milky then horny exudation, or from the seed squeezed into a square-like form similar to vertebræ (αστράγαλος) in some species.

Gum'mif-er. L. *gummi*, gum, + *ferre*, to bear—*i. e.*, plant produces gum.

Trag-a-can'tha. L. fr. Gr. τράγος a goat, + ἄκανθα, thorn—a goat thorn—*i. e.*, plant thorny like goat's head, and hedges made of it resist their onslaughts.

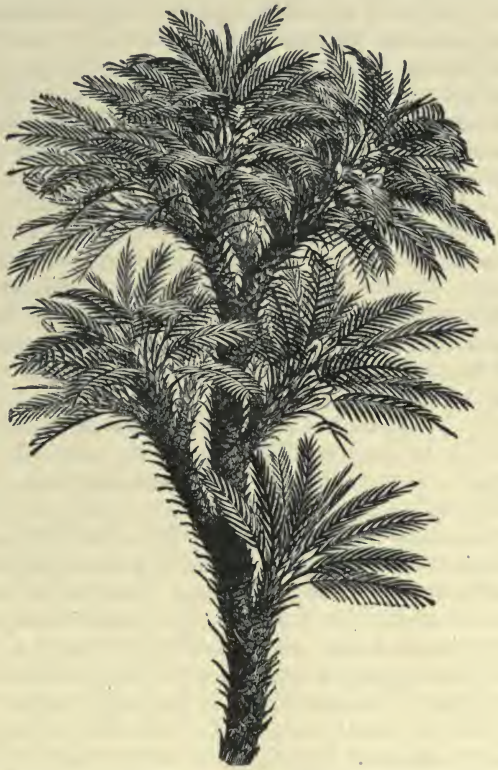


Fig. 196.—*Astragalus gummifer* (natural size of branch).

Plant.—Shrub .6–1 M. (2–3°) high; stem naked with many straggling, much ramified branches; bark reddish-gray, rough, and marked with leaf-scars, young twigs woolly; leaves 3 Cm. ($1\frac{1}{5}'$) long, closely placed, pinnate, rachis hard, stiff, persistent for some years as a woody spine, yellow, very sharp-pointed; leaflets 10–15 pairs, 3 Mm. ($\frac{1}{8}'$) long, obovate, grayish-green; flowers small, pale yellow; stamens 10, upper one free, others united in a sheath; fruit small, oblong pod, covered with white hairs; seed 1, reniform, smooth, pale brown. GUM (tragacanth), in flattened, lamellated fragments varying from ribbon-shaped bands to long linear pieces, straight or spirally twisted, .5–2.5 Mm. ($\frac{1}{50}$–$\frac{1}{10}'$) thick, whitish, brownish, translucent, horny; fracture short, easily pulverizable by heat (50° C.; 122° F.); inodorous; taste insipid, mucilaginous. POWDER, whitish, forming with water a translucent mucilage; microscopically—numerous starch grains, .003–.025 Mm. ($\frac{1}{8325}$–$\frac{1}{1000}'$) broad, occasional 2–4 compound, many swollen and more or less altered, due to excessive heat used in drying before powdering, by which it loses 15 p. c. *Tests:* 1. Add 1 Gm. to 50 Ml. (Cc.) of distilled water—swells and forms a smooth, nearly uniform, stiff, opalescent mucilage free from cellular fragments (Indian gum—uneven mucilage with few reddish-brown fragments, separating on stirring in coarse, uneven strings. 2. Shake 2 Gm. with 100 Ml. (Cc.) of water, when fully swollen and free from lumps add 2 Gm. of powdered sodium borate, shake until dissolved—mucilage does not lose transparency, change consistency, or appear slimy or stringy on pouring, even after standing 24 hours (abs. of foreign gums). *Solvents:* hot water; cold water best. Dose, gr. 5–30 (.3–2 Gm.).

ADULTERATIONS.—*Cherry Gum* (cherry, almond, plum, etc.)—in irregular brownish nodules, insoluble portion not identical with bassorin; *Indian* (*Bassora, Kutera, Hogg*) *Gum*, Persia—broken up in Smyrna and mixed with tragacanth; occurs in yellowish-brown (sometimes whitened with lead carbonate), angular, tasteless masses, swelling with water; *Cashew Gum*—brownish-yellow, translucent, iridescent, partly soluble in water.

Commercial.—Tragacanth is not a simple plant juice, but a degenerative product due to the transformation of the cell-walls of pith and medullary rays in the stem and older branches, and exudes spontaneously, July–August, through natural, or artificial punctures, longitudinal and transverse incisions (near the base of stem) into the medullary part which alone yields juice; it only flows at night, the shape of opening and rate determining its final congealed outline, the time of hardening for collection (1–2 weeks, dry weather 3–4 days) governing its color—white if congealed rapidly, yellow to brown if slowly, from long exposure to changeable weather; the surface lines indicate the daily concretion while the whiter and more translucent possess greatest value. There are several varieties: 1, *Flake* (*Leaf, Smyrna*), usually in broad, thick, yellowish flakes, prominently ridged; the ribbon-like and white flakes are produced in Kurdistan, Persia, often being designated as Syrian; 2, *Vermiform* (*Vermicelli*), in very narrow contorted string-like pieces, or confluent coils; 3, *Common* (*Sorts*), called in Europe *traganton*, being the result of spontaneous exudation and incidental collection while gathering higher grades; occurs in tear-like pieces, rounded or irregular, brownish, waxy, and, like the preceding varieties, encloses starch. Enters commerce from ports of Asia Minor (Smyrna, Constantinople), Persian Gulf, Bagdad, etc.

Constituents.—Cellulose, Soluble gum, Bassorin, Polyarabinan-brigatactan-geddic acids, Starch, nitrogenous matter, α-tragacanthan-xylan-bassoric acid, xylan-bassoric acid, bassoric acid, β-tragacanthan-xylan-bassoric acid, ash 3.5 p. c. (more than one-half being calcium carbonate).

Cellulose.—The portion of gum insoluble in boiling water, in cold diluted acids and alkalies; when treated with boiling diluted sulphuric acid yields arabinose, and a cellulosic residue which is soluble in ammonia and bromine.

Soluble Gum.—Not identical with arabin, although its solution is precipitated by alcohol and ammonium oxalate; yields a series of gum acids having the nature of the "geddic acids," but are lævorotatory, whereas geddic acids are dextrorotatory.

Bassorin.—This is an acid which yields a barium salt and two isomeric acids—α- and β-tragacanthan-xylan-bassoric acid when acted upon by excess of an alkali; the former is soluble in cold water and yields sparingly soluble salts of barium, calcium, and silver; when digested with diluted sulphuric acid yields tragacanthose and xylan-bassoric acid, which when further acted on by 5 p. c. sulphuric acid yields xylan and bassoric acid.

Preparations.—1. *Mucilago Tragacanthæ.* Mucilage of Tragacanth. (Syn., Mucil. Trag.; Fr. Mucilage de Gomme Adragante; Ger. Traganthschleim.)

Manufacture: 6 p. c. Mix glycerin 18 Gm. with water 75 Ml. (Cc.) in a tared vessel, heat to boiling, remove heat, add tragacanth 6 Gm., macerate 24 hours, stirring occasionally, add water q. s. 100 Gm., beat until uniform consistence, strain forcibly through muslin. Dose, ℥j–2 (30–60 Ml. (Cc.)).

Prep.: 1. *Trochisci Sodii Bicarbonatis,* q. s.

2. *Pilulæ Ferri Carbonatis,* $\frac{1}{7}$ gr. (.01 Gm.). 3. *Trochisci Acidi Tannici,* $\frac{1}{3}$ gr. (.02 Gm.). 4. *Trochisci Ammonii Chloridi,* $\frac{1}{3}$ gr. (.02 Gm.). 5. *Trochisci Potassii Chloratis,* $\frac{1}{2}$ gr. (.03 Gm.).

Unoff. Prep.: Glycerite, 12.5 p. c., + glycerin 77.5, water 18.5.

Properties.—Demulcent, emollient, protective, nutritious.

Uses.—Was not known to the Greeks until 4th–5th century, when its uses were as now—expectorant, for cough, hoarseness, similar to acacia; its superior adhesiveness over the latter renders it a better protective in excoriated surfaces, ulcers, burns, etc. Employed largely for suspending resins, oils, heavy powders, etc., in emulsion. Also to cohere pills (paste: ʒj + glycerin ℥j; 4 Gm., + 30 Gm.), troches, etc.; its partial insolubility in the stomach restricts somewhat its popularity.

Allied Plants:

1. *Astragalus bœ'ticus.*—Mediterranean basin; seeds used for coffee. *A. exsca'pus;* C. and S. Europe, mountains; root mucilaginous, astringent, bitter, diuretic. *A. glycyphyl'los,* Europe; leaves and seed sweetish, diuretic. *A. crotala'riæ, Loco Weed, Rattle Weed,* and *A. mollis'simus,* N. America (Cal., Neb., Tex.); poisonous to cattle, horses, etc., causing spinal tetanic action.

RECAPITULATION No. 3.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
Lauraceæ: 1. Cinnamomum Saigonicum. 2. Saigon Cinnamon.	Undetermined species.	The dried bark.	China, Annam, Java, Sumatra, S. America.	Volatile oil, tannin, sugar, mannite, starch.	Tinct., ar. powd., fluidextr. ar., tr. card. co., tr. gambir. co., tr. lav. co., tr. rhei ar. *Oil:* aqua, spirit, inf. dig., mist. cret., syr. rhei., ar. sulph. ac.	Germicide, antispasmodic, carminative, stimulant, astringent, aromatic.	Parturient, flavoring, diarrhœa, flatulence, nausea, menorrhagia.	Grains. 5–30 (.3–2 Gm.).
1. Cinnamomum Zeylanicum. 2. Ceylon Cinnamon.	Cinnamomum Zeylanicum.	The inner bark.						
1. Camphora. 2. Camphor.	Cinnamomum Camphora.	The dextro-rotatory ketone.	China, Japan, Formosa.	$C_{10}H_{16}O$.	Aq., lin., spt., lin. belladon., lin. sap., tr. opii camph., monobromated.	Antispasmodic, stimulant, nervine, diaphoretic, resolvent, antiseptic.	Hysteria, nervousness, diarrhœa, colic, rheumatism, tenesmus, asthma, cough, ulcers, scabies.	1–5 (.06–.3 Gm.).
Papaveraceæ: 1. Opium. 2. Opium.	Papaver somniferum, var. album.	The air-dried milky exudation.	W. Asia.	Morphine, narcotine, codeine, narceine, meconic acid, ethylmorphine, apomorphine, cotarnine, etc.	Extr., tr., tr. opii deod., tr. opii camph., pulv. ip. et opii, opium deod., gran., opii pulv.	Narcotic, sedative, anodyne.	Diarrhœa, peritonitis, cholera morbus, coughs, rheumatism, etc.	1–2 (.06–.13 Gm.).
1. Sanguinaria. 2. Sanguinaria.	Sanguinaria canadensis.	The dried rhizome and roots.	N. America.	Chelerythrine, sanguinarine, protopine, β-homochilidonine, resin, starch.	Tincture.	Emetic, stimulating expectorant, tonic, alterative, cardiac paralyzer, irritant.	Bronchitis, croup, asthma, pneumonia, dyspepsia, jaundice, syphilis.	1–30 (.06–2 Gm.).
Cruciferæ: 1. Sinapis Alba. 2. White Mustard.	Sinapis alba.	The ripe seeds.	Asia, S. Europe.	Fixed oil, sinalbin, sinapine sulphocyanide, myrosin.	. . . .	Stimulant, emetic, tonic, diuretic, laxative, rubefacient, condiment.	Dyspepsia, delirium tremens, dropsy, poisoning, rheumatism, gout, colic, headache, etc.	15–60 (1–4 Gm.).
1. Sinapis Nigra. 2. Black Mustard.	Brassica nigra.	The ripe seeds.	Asia, S. Europe.	Fixed oil, sinigrin, sinapine sulphocyanide, myrosin.	Emplast., vol. oil.			
Hamamelidaceæ: 1. Aqua Hamamelidis. 2. Hamamelis Water.	Hamamelis virginiana.	From bark, twigs, stems.	N. America.	Tannin, bitter principle, volatile oil.	Aqua (distilled).	Astringent, hæmostatic, sedative, tonic.	Hemorrhages, tumors, hemorrhoids, varicose veins.	Minims. 60–240 (4–15 Ml. (Cc.)).
1. Styrax. 2. Storax.	Liquidambar orientalis.	The balsam.	Asia Minor.	Styrol, styracin, phenylpropyl cinnamate, cinnam. benzo. acids, storesin, vanillin.	Tinct. benzoini comp.	Stimulant, expectorant, diuretic, antiseptic.	Bronchitis, catarrhs, gleet, phthisis, asthma, amenorrhœa.	10–30 (.6–2 Gm.).

Rosaceæ: 1. Rosa Gallica. 2. Red Rose.	Rosa gallica.	The dried petals.	W. Asia.	Volatile oil, mucilage, tannin, quercitrin, sugar.	Fluidextract, mel., aq., aq. fort., ung.	Tonic, mild astringent, carminative.	Hemorrhages, aphthæ, ulcers, inflamed eyes, flavoring, perfumery.	Grains. 15–60 (1–4 Gm.).
Drupaceæ: 1. Prunus Virginiana. 2. Wild Cherry.	Prunus serotina.	The stem bark.	N. America.	Amygdalin, emulsin, bit. prin., tannin, resin, gallic a id.	Syrup.	Sedative, pectoral, tonic, astringent.	Consumption, cough, scrofula, dyspepsia, debility, intermittents.	30–60 (2–4 Gm.).
1. Oleum Amygdalæ Amaræ. 2. Oil of Bitter Almond.	Prunus Amygdalus, var. amara.	The volatile oil.	W. Asia.	Benzaldehyde, hydrocyanic acid.	Aq., spirit.	Demulcent, nutrient, sedative.	Coughs, pulmonary affections, flavoring.	Minims. ¼–1 (.16–.06 Ml. (Cc.)).
1. Amygdala Dulcis. 2. Sweet Almond.	Prunus Amygdalus, var. dulcis.	The ripe seeds.	W. Asia.	Fixed oil, emulsin, mucilage, sugar, proteids.	Emul., *Oil:* Emul. ol. terebinth., ung. aq. rosæ.	Demulcent, nutrient.	Diabetes, confectionery.	Grains. ad lib.
Mimosaceæ: 1. Acacia. 2. Acacia.	Acacia Senegal, +	The dried gummy exudation.	E. and W. Africa.	Arabic acid, combined with Ca, Mg, K, sugar.	Mucil., syr., emuls., mist. glycyr. co., pulv. cretæ co., pills, troches.	Demulcent, emollient, nutritive.	Coughs, gastritis, dysentery, hemorrhages, typhoid, emulsifier, excipient.	ad lib.
Cæsalpinaceæ: 1. Senna. 2. Senna.	Cassia: acutifolia, angustifolia.	The dried leaflets.	E. and C. Africa, India.	Anthraglucosennin, emodin, chrysophan. acid, isoemodin, senna-rhamnetin, sennanigrin.	Fluidextr., syr., co. infus., pulv. glycyr. co., syr. sars. co.	Cathartic.	Constipation, hemorrhoids, fissures, fevers.	30–180 (2–12 Gm.).
1. Copaiba. 2. Copaiba.	Copaiba: one or more species.	The oleoresin.	Brazil.	Volatile oil, resin, bitter principle, copaivic acid.	....	Diuretic, stimulant, expectorant, laxative.	Urinary affections, cystitis, bronchitis, hemorrhoids, dropsy, gonorrhœa.	Minims. 10–60 (.6–4 Ml. (Cc.)).
Papilionaceæ: 1. Balsamum Peruvianum. 2. Balsam of Peru.	Toluifera Pereiræ.	The balsam.	C. America.	Cinnamein (vol. oil), resin, cinnamic, and benz. acids, vanillin.	....	Stimulant, expectorant, vulnerary, stomachic.	Catarrhs, phthisis, gonorrhœa, rheumatism, ulcers, eczema, scabies.	5–30 (.3–2 Ml. (Cc.)).
1. Balsamum Tolutanum. 2. Balsam of Tolu.	Toluifera Balsamum.	The balsam.	S. America.	Resin, volatile oil, cinnamic and benzoic acids, vanillin.	Syrup, tincture, tinct. benzoini comp.	Stimulant, expectorant, vulnerary.	Bronchitis, catarrhs, coughs, flavor, perfumery.	Grains. 5–30 (.3–2 Gm.).
1. Tragacantha. 2. Tragacanth.	Astragalus gummifer, +.	The spon. dried gummy exudation.	W. Asia.	Bassorin, calcium, compound of a gummic acid, starch.	Mucilage.	Demulcent, nutritious, expectorant.	Coughs, protective, excipient to pills and troches.	5–30 (.3–2 Gm.).

SANTALUM RUBRUM. RED SAUNDERS.

Pterocarpus santalinus, } The heart-wood.
Linné filius.

Habitat. Madras; cultivated in S. India, Ceylon, Philippines.

Syn. Santal. Rub.; Br. Pterocarpi Lignum, Red Saunders (Sandal) Wood, Red Santal, Chandam, Chundana, Ruby Wood; Fr. Santal Rouge; Ger. Rothes Sandelholz.

Pter-o-car'pus. L. from Gr. πτερόν wing, + καρπός fruit—*i. e.*, its winged fruit pods or legumes girdled with a broad crisped wing.

San-ta-li'nus. L. adj. form fr. *sandal*, Pers. *sandal*, useful; Gr. σάνταλον.

San'ta-lum. L. noun form; sandalwood, saunders.

Ru'brum. L. *ruber*, red, ruddy—*i. e.*, the color of the wood.

Plant.—Tree 6–9 M. (20–30°) high, .3–.5 M. (12–18′) thick, some trunks hollow; leaves trifoliate; leaflets broadly oval, emarginate, 5–15 Cm. (2–6′) long, hoary beneath; flowers yellow, papilionaceous corolla, spikes; fruit orbicular legume, wing slightly crisped, 2-seeded. Heart-wood, in billets, logs, 1–1.6 M. (3–5°) long, 10–20 Cm. (4–8′) thick, deprived of light-colored sap-wood, hard, heavy, dark reddish-brown, splitting coarse-splintery; usually in coarse powder, brownish-red, dark saffron, nearly odorless and tasteless; microscopically—numerous wood-fibres of irregular outline and sharp pointed ends, occasionally forked, lumina filled with fine, granular protoplasmic content, occasional tracheæ filled with yellow, resinous masses, medullary rays 1 cell wide, 3–6 deep, crystal fibres with prisms of calcium oxalate; mounts in hydrated chloral T. S.—deep, rich red color. *Tests:* 1. Mix .5 Gm. with ether 10 Ml. (Cc.)—solution orange-yellow, with greenish fluorescence in bright light; .5 Gm. with alcohol 10 Ml. (Cc.)—solution distinctly red. 2. Mix .005 Gm. with water 10 Ml. (Cc.)—liquid clear and colorless. *Solvents:* alcohol; ether; acetic acid; alkaline solutions; boiling water or diluted alcohol partially.

Preparation.—1. *Tinctura Lavandulæ Composita*, 1 p. c.

Constituents.—Santalin .25–.5 p. c., Santal, Pterocarpin, Homopterocarpin.

Santalin (*santalic acid*), $C_{15}H_{14}O_5$.—Coloring matter, obtained by precipitating alcoholic tincture with lead acetate, washing precipitate with hot alcohol, decomposing it with hydrogen sulphide in the presence of alcohol, evaporating; occurs in red needles, inodorous, tasteless, resinous, soluble in alcohol (blood-red), ether (yellow), sulphuric acid (deep red), alkalies (violet), also in oils of clove, cinnamon, bergamot, bitter almond.

Santal, $C_8H_6O_3$, Pterocarpin, $C_{20}H_{16}O_6$, Homopterocarpin, $C_{24}H_{24}O_6$.—All occur in colorless scales—the latter soluble in carbon disulphide and when fused with potassium hydroxide yields phloroglucin.

Uses.—Red Saunders has no important medicinal properties, being used only for imparting color. Employed natively as an astringent and with sapan wood for dyeing silk, cotton, wool, giving various reds according to mordants used.

PAPILIONACEÆ

Allied Plant:

1. *Ichthyome'thia Piscip'ula* (*Piscid'ia Erythri'na*), *Jamaica Dogwood.*—W. Indies. Well-developed tree, whose bark has long been used for catching fish, orange-yellow, fissured, tough, fibrous, odor opium-like, taste bitter, acrid. Narcotic, analgesic, soporific; neuralgia, nervous insomnia, whooping-cough, dysmenorrhœa; similar to opium, but devoid of unpleasant after-effects. Dose, ʒss–1 (2–4 Gm.), extract, fluidextract.

KINO. KINO.

Pterocarpus Marsupium, *Roxburgh.* } The spontaneously dried juice.

Habitat. E. India, in forests; C. and S. India (Malabar), Ceylon, Bengal.

Syn. Gummi (Resina) Kino, Vengay, Bastard Teak, Bija, Amboyna Kino Tree; Br. Kino, Kino Eucalypti (Eucalyptus (Red) Gum); Fr. Kino de l'Inde; Ger. Kino.

Mar-su'pi-um. L. *marsupium*, a pouch, bag, purse—*i. e.*, shape of the fruit.
Ki'no. E. India name as given the extract.

Plant.—Large tree, 18–24 M. (60–80°) high, .6–1 M. (2–3°) thick, many spreading branches; bark brownish-gray, internally red and fibrous; leaves alternate, imparipinnate, deciduous; leaflets 5–7, alternate, 5–10 Cm. (2–4′) long, obovate, emarginate, coriaceous; flowers May–June, pale yellow; fruit indehiscent pod, orbicular, 2.5–4 Cm. (1–$1\frac{3}{5}$′) broad; seed 1, kidney-shaped. Juice (kino), in small, brittle, angular fragments, 1–15 Mm. ($\frac{1}{25}$–$\frac{3}{5}$′) broad, reddish-brown, blackish; crushed upon slide and under microscope—translucent, glass-like, conchoidal surface, the thinner pieces yellowish-red, brownish-red, and often marked by nearly parallel, curved and straight lines; inodorous; taste very astringent; when masticated colors saliva pinkish. Powder, dark brick-red; microscopically—with water fragments deep, rich red, rounded and separated into innumerable small granules associated with rod-shaped bacteria; mounted in alcohol fragments deep red at first, then mostly dissolve, leaving small, colorless granules and indistinguishable cellular fragments. *Tests:* 1. Add boiling water, which dissolves at least 40 p. c., cool, filtrate faintly acid; with ferric chloride T. S.—dark green precipitate; with alkalies—reddish-violet color; alcoholic extractive 45 p. c.; moisture 12 p. c. *Solvents:* alcohol, to the extent of 90 p. c.; boiling water to the extent of 40–80 p. c.; alkalies, with impairment of astringency. Dose, gr. 5–20 (.3–1.3 Gm.).

Adulterations.—Inferior juices, catechu, dragon's blood (insoluble in water), etc.

Commercial.—Plant, called natively *B'uja*, is prized for fine timber and juice, the privilege of tapping trees for the latter being granted by the government to highest bidders; it is collected to some extent the entire year, but chiefly during inflorescence, dry season, February–March (when it is better and easier dried), by cutting into the tree-trunk to the cambium a perpendicular incision and lateral feeders; the juice, resembling currant-jelly, exudes freely into clay cups, bamboo-joints, etc., placed at the bottom of main incision, when it is dried in the sun and air (inspissated) or boiled to the consistency of a thick extract, occasionally skimming off impurities, then poured into shallow pans to dry until crumbly (half-inch layer requiring a week) and packed in wooden boxes for market. Trees yield most at night and when small often are killed by excessive bleeding, which may be averted by resting alternate years; each produces about 24 ounces (.7 Kg.) that upon evaporation becomes half as much kino. All liquid preparations tend to gelatinize and lose astringency, consequently should be kept in small bottles and seldom opened; the menstruum making a permanent solution is alcohol 65, water 20, glycerin 15 volumes, although alcohol 50, water 25, glycerin 25 usually gives satisfaction. There are several varieties: 1, *Malabar* (*E. India*), official, described above, rarely found on the market; 2, *African* (*Gambia—P. erina'ceus*), similar to preceding, not in our market but common in England; contains tannin 50–60 p. c.; 3, *Bengal* (*Palas—Bu'tea frondo'sa*) in transparent ruby-red tears, fragments, often with leaf-vein impressions, brittle, not adhesive on mastication, yields pyrocatechin on dry distillation, one-third to one-half soluble in hot alcohol, the remainder being mucilaginous matter; contains tannin 15–35 p. c.; 4, *Australian* (*Botany Bay—Eucalyptus rostra'ta, E. amygdalina, E. resinif'era,* and other species of Myrtaceæ), not very brittle, adheres to teeth, tinges saliva red, soluble in alcohol, 80–90

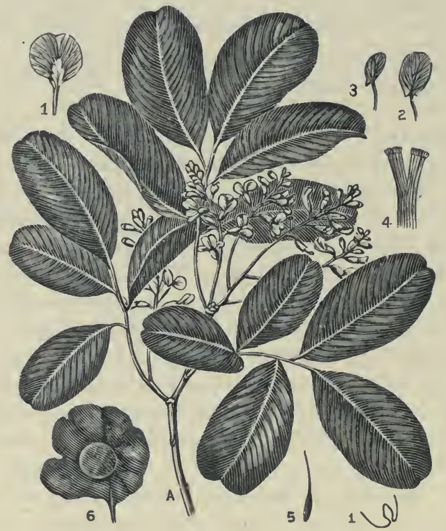


Fig. 197.—*Pterocarpus Marsupium* (Kino): *A*, flowering twig; *1, 2, 3,* parts of the flower; *4*, stamens; *5*, pistil; *6*, fruit; *7*, vertical section of winged fruit.

p. c., in water, lessening with age; furnishes much of the present commercial kino; contains tannin 45–50 p. c.; 5, *W. India* (*Jamaica, Caracas—Coccol'oba uvif'era*, Polygonaceæ), obtained by boiling the violet-brown wood and bark of the large tree, evaporating the decoction; resembles official but has brownish tint, less glossy, bitter, soluble in water, alcohol (90 p. c.); contains tannin 70 p. c.

CONSTITUENTS.—Kino-tannic acid, $C_{18}H_{18}O_8$, 40–80 p. c., Kino-red, $C_{28}H_{22}O_{11}$, Pyrocatechin (pyrocatechuic acid, catechol), $C_6H_6O_2$, Kinoin, $C_{14}H_{12}O_6$, gum, ash 1.3–3 p. c.

Kino-tannic Acid.—Similar to catechuic acid, always mixed with coloring matter and pectin in extraction; with ferric salts—greenish-black, with ferrous salts in neutral solutions—violet color.

Kino-red.—Obtained by exposing cold aqueous solution to the air, when red precipitate slowly forms, hastened by heating, or heat kinoin to 130° C. (266° F.); it is amorphous, tasteless, nearly insoluble in water, and is the anhydride of kinoin: $2C_{14}H_{12}O_6—H_2O = C_{28}H_{22}O_{11}$.

Pyrocatechin.—Obtained by treating kino with ether, or the product of dry distillation of kino contains much of it, which may be purified by resublimation; soluble in ether, water.

Kinoin.—Boil kino with diluted hydrochloric acid, kino-red immediately separates, now agitate clear solution with ether; occurs in white crystals, slightly soluble in ether, cold water, red with ferric chloride.

PREPARATIONS.—1. *Tinctura Kino.* Tincture of Kino. (Syn., Tr. Kino; Fr. Teinture de Kino; Ger. Kinotinktur.)

Manufacture: 10 p. c. Agitate thoroughly in a flask 10 Gm. with boiling water 50 Ml. (Cc.), heat for 1 hour on water-bath containing boiling water, shaking frequently, cool, add recently boiled water q. s. 50 Ml. (Cc.), then add alcohol 50 Ml. (Cc.), stopper flask, set aside in cool place for 24 hours, decant through cheesecloth. Should be kept cool, dark, in small, tightly-corked bottles. Dose, ʒss–2 (2–8 Ml. (Cc.)).

Unoff. Preps.: Compound Tincture with Opium, 20 p. c. (tincture), + tincture of opium 10 p. c. *Fluidextract*, dose, ♏v–30 (.3–2 Ml. (Cc.)). *Gargles. Infusion*, 5 p. c., dose, ℥ss–1 (15–30 Ml. (Cc.)). *Pulvis Kino Compositus* (Br.), 75 p. c. (+ opium 5, cinnamon 20), dose, gr. 5–20 (.3–1.3 Gm.). *Kino Eucalypti* (*Eucalypti Gummi*—Br.), red exudation from *E. rostra'ta*, +, dose, gr. 2–5 (.13–.3 Gm.).

Owing to gum (pectin) coagulating, the liquid preparations are very unstable, therefore catechu is used often in its stead with equally good results.

PROPERTIES.—Astringent, tonic, hæmostatic; similar to but less powerful than tannin; locally inferior to other astringents.

USES.—Diarrhœa, pyrosis, menorrhagia, dysentery, leucorrhœa, ulcers, sore throat, manufacture of wines. Useful in dyeing and tanning, but rather too expensive.

Incompatibles: Aqueous solution is precipitated by gelatin, soluble salts of iron, silver, lead, antimony, mercuric chloride, sulphuric, nitric, and hydrochloric acids.

GLYCYRRHIZA. GLYCYRRHIZA.

Glycyrrhiza glabra, var. {**typica,** *Regel et Herder,* **glandulifera,** *Regel et Herder.*} The dried rhizome and roots.

Habitat. S. Europe, W. Asia, Syria, Persia, N. Africa; cultivated in Russia, Spain, England, France, Germany, United States, China.

Syn. Glycyrrh., Licorice, Liquorice Root, Sweet Wood, Italian Juice Root (Wood), Spanish Juice Root, Radix Glycyrrhizæ Hispanicæ; Br. Glycyrrhizæ Radix; Fr. Réglisse, Bois de Réglisse—doux, Racine douce; Ger. Radix liquiritiæ, Süssholz, Spanisches Süssholz, Lakritzenholz.

Glyc-yr-rhi'za. L. fr. Gr. γλυκύρριζα—γλυκός, sweet, + ρίζα, root—*i. e.*, its saccharine taste (Dioscorides).

Gla'bra. L. *glaber*, smooth, hairless—*i. e.*, pods, leaves smooth on both sides.

Glan-du-lif'e-ra. L. *glandula*, a gland, + *ferre*, to bear—*i. e.*, pods covered with thick glandular spines.

Ty'pi-ca. L. *typicus*, typical, representative—*i. e.*, possessing the strongest characteristics of its group.

Lic'o-rice—Liq'uo-rice (lik'o-ris). Fr. L. *liquiritia*, corruption of *glycyrrhiza*.

Plants.—Perennial herbs; stem .6–1.5 M. (2–5°) high, several from the (crown) thick rhizome; leaves imparipinnate; leaflets 4–7 pairs, ovate, entire, smooth, glutinous beneath, dark green; flowers yellowish-white or purplish, pulse-shaped, racemes; fruit legume, 2.5 Cm. (1′) long, brown, ovate, flat, 1-celled, 1–6-(kidney-shape) seeded; *G. glabra*, var. *glandulifera*—stem somewhat pubescent; leaves hairy, glandular beneath; legumes glandular, prickly. Rhizome (*G. glabra*, var. *typica*): *Spanish*, subcylindrical, upper portion somewhat knotty, usually in pieces 14–20 Cm. (6–8′) long, 5–20 Mm. ($\frac{1}{5}$–$\frac{4}{5}$′) thick, yellowish-brown, longitudinally wrinkled; thinner rhizomes often having prominent alternate buds, thicker having distinct corky patches; fracture coarsely fibrous; internally lemon-yellow, radiate; bark 1–3 Mm. ($\frac{1}{25}$–$\frac{1}{8}$′) thick; wood porous, in narrow wedges, rhizome with small pith; odor distinctive; taste sweetish, slightly acrid; (*G. glabra*, var. *glandulifera*): *Russian*, subcylindrical, somewhat tapering, sometimes split longitudinally, 15–30 Cm. (6–12′) long, 1–5 Cm. ($\frac{2}{5}$–2′) thick, pale yellow when deprived of outer corky layer; fracture coarsely fibrous; internally lemon-yellow; wood radially cleft; less sweet than preceding. Powder, brownish-yellow with reddish-brown cork cells (Spanish); pale yellow without reddish-brown cork cells (Russian); microscopically—numerous wood-fibres, bast-fibres, and starch grains, .002–.02 Mm. ($\frac{1}{12500}$–$\frac{1}{1250}$′) broad, tracheæ, calcium oxalate prisms. *Tests:* 1. Macerate for 15 minutes 10 Gm. in distilled water 100 Ml. (Cc.), heat a half-hour, add to filtrate water q. s. 100 Ml. (Cc.), evaporate 10 Ml. (Cc.)—residue .2 Gm. Should be kept in tightly-closed containers, adding occasionally a few drops of chloroform or carbon tetrachloride to prevent insect attack. *Solvents:* water; diluted alcohol. Dose, gr. 15–60 (1–4 Gm.).

Adulterations.—The one variety of the root with the other, as they often are collected together; also the underground stem, which resembles the root, but has a thin central pith.

Commercial.—Plants, like lemon and orange, do not thrive in cold latitudes, becoming woody and less sweet, and while formerly the wild grown, owing to hardy, persistent rapacious habit, supplied the demand, now it is cultivated extensively by planting cuttings in rows, 4 feet (1.3 M.) apart. Roots are dug when sweetest, autumn of 4th year, by removing the earth 2–3 feet (.6–1 M.) deep, the entire length of rows, thereby exposing subterranean portion and allowing easy pulling up of whole plants, from which roots are taken, cleaned, washed, trimmed, assorted, cut into suitable lengths, and marketed via Alicante, Tortosa, Hamburg, in bundles, bales, bags. There are two varieties: 1, *Spanish* (*Italian, Turkish, Alicante, Tortosa*—*G. glabra*, var. *typica*), usually *unpeeled* and for a long time most esteemed, but as bitterness and acridity reside in the bark it now constitutes only one-tenth of that consumed; 2, *Russian* (*G. glabra*, var. *glandulifera*), usually *peeled*, larger, richer in glycyrrhizin and extractives, and in far greater demand. The Calabrian is preferred by many, while the Italian and Sicilian are consumed at home for making the extract.

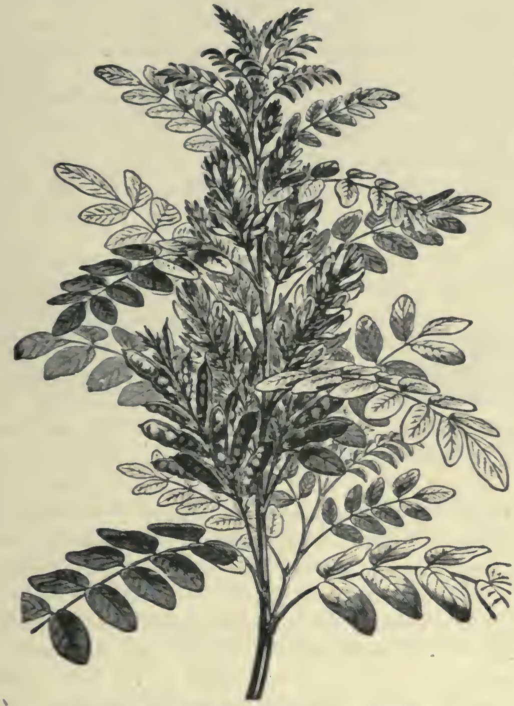


FIG. 198.—*Glycyrrhiza glabra*, var. *typica*.

ADULTERATIONS.—Roots of allied species, worm-eaten, decayed and discolored pieces, fibrous roots (little sweetness), underground stem having thin central pith, otherwise closely resembling root.

CONSTITUENTS.—Glycyrrhizin, $C_{44}H_{63}NO_{18}$, 6–8 p. c., Glycyramarin, $C_{36}H_{57}NO_{13}$ (bitter principle, mostly in the bark), saccharose, glucose, asparagin 2–4 p. c., fat .8 p. c., volatile oil .03 p. c., gum, tannin, starch, resin, yellow coloring matter, ash 5–7 p. c.

Glycyrrhizin.—This is combined with ammonia, being called glycyrrhizate of ammonium or glycyrrhizic acid. It is a tribasic acid (glucoside) obtained from cold infusion by coagulating albumin with heat, filtering, precipitating with sulphuric acid, washing precipitate with water, dissolving it in alcohol to which a little ether has been added (or in very weak ammonia water, 1 to 10), filtering, evaporating; it is very soluble in water, sparingly in alcohol, ether, when boiled with diluted sulphuric acid (by hydrolysis) splits into parasaccharic acid (glucose), $C_6H_{10}O_8$, and bitter resinous glycyrrhetin, $C_{32}H_{47}NO_4$.

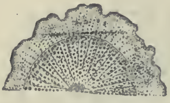


FIG. 199.—*Glycyrrhiza glabra*, var. *typica* (rhizome), natural size.

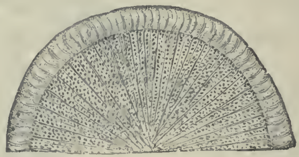


FIG. 200.—*Glycyrrhiza glabra*, var. *glandulifera* (root).

PREPARATIONS.—1. *Extractum Glycyrrhizæ.* Extract of Glycyrrhiza. (Syn., Ext. Glycyrrh., Extract of Licorice, Extractum liquiritiæ, Licorice; Fr. Suc (jus) de Réglisse, Sucre noir; Ger. Succus liquiritiæ, Süssholzsaft, Lakritz, Lakritzensaft.)

Manufacture: Evaporate decoction to proper consistence, pulverize or mold. This is the commercial extract, in flattened, cylindrical masses or rolls, 15–18 Cm. (6–7′) long, 15–30 Mm. ($\frac{3}{5}$–$1\frac{1}{5}$′) thick, glossy black, brittle, sharp, smooth, conchoidal fracture; characteristic, sweet taste; yield 26–32 p. c., containing glycyrrhizin 10–24 p. c.; at least 60 p. c. soluble in cold water; powder brown; ash 6 p. c. Dose, *ad libitum.*

Preps.: 1. *Pilulæ Ferri Iodidi,* $\frac{1}{6}$ gr. (.01 Gm.). 2. *Trochisci Ammonii Chloridi,* 3 gr. (.2 Gm.). 3. *Trochisci Cubebæ,* 4 gr. (.26 Gm.).

2. *Extractum Glycyrrhizæ Purum.* Pure Extract of Glycyrrhiza. (Syn., Ext. Glycyrrh. Pur.; Br. Extractum Glycyrrhizæ, Extractum Glycyrrhizæ Depuratum; Fr. Extrait de Réglisse (pur); Ger. Succus Liquiritiæ depuratus, Gereinigter Süssholzsaft.)

Manufacture: Macerate, percolate 100 Gm. with water 300 Ml. (Cc.) + ammonia water 15 Ml. (Cc.), proceed with chloroform water until exhausted, evaporate to pilular consistency; yield 16–25 p. c. Dose, *ad libitum.*

Preps.: 1. *Mistura Glycyrrhizæ Composita.* Compound Mixture of Glycyrrhiza. (Syn., Mist. Glycyrrh. Co., Brown Mixture; Fr. Mixture de Réglisse; Ger. Lakritzenmixtur.)

Manufacture: Rub in a mortar until dissolved pure extract of glycyrrhiza 3 Gm., acacia 3 Gm., with warm water 50 Ml. (Cc.), cool, transfer to graduated vessel, add antimony and potassium tartrate .024 Gm., dissolved in water 1.2 Ml. (Cc.), then syrup 5 Ml. (Cc.), camphorated tincture of opium 12 Ml. (Cc.), spirit of nitrous ether 3 Ml. (Cc.), rinse mortar with water q. s. 100 Ml. (Cc.), mix thoroughly. Dose, ʒj–4 (4–15 Ml. (Cc.)).

2. *Fluidextractum Cascaræ Sagradæ Aromaticum,* 4 p. c.

3. *Fluidextractum Glycyrrhizæ.* Fluidextract of Glycyrrhiza. (Syn., Fldext. Glycyrrh., Fluid Extract of Glycyrrhiza, Fluidextract of Licorice; Br. Extractum Glycyrrhizæ Liquidum; Fr. Extrait fluide de Réglisse; Ger. Süssholzfluidextrakt.)

Manufacture: Macerate, percolate 100 Gm. with chloroform water 270 Ml. (Cc.) + ammonia water 30, proceed with more menstruum until exhausted, reserve first 50 Ml. (Cc.), evaporate remainder to soft extract, which dissolve in the reserve, add water q. s. 75 Ml. (Cc.), and gradually alcohol 25 Ml. (Cc.), let stand 7 days, decant, filter, wash filter with 25 p. c. alcohol q. s. 100 Ml. (Cc.). Dose, ʒss–1 (2–4 Ml. (Cc.)).

Preps.: 1. *Elixir Glycyrrhizæ.* Elixir of Glycyrrhiza. (Syn., Elix. Glycyrrh., Elixir Adjuvans, U. S. P. 1900, Elixir of Licorice, Flavoring Elixir; Fr. Elixir de Réglisse—adjuvant; Ger. Gewürzhaftes Lakritzenelixir.)

Manufacture: Mix fluidextract of glycyrrhiza 12.5 Ml. (Cc.) with aromatic elixir 87.5 Ml. (Cc.), filter. Dose, *ad libitum;* as a flavoring vehicle.

2. *Syrupus Sarsaparillæ Compositus,* 1.5 p. c.

4. *Glycyrrhizinum Ammoniatum.* Ammoniated Glycyrrhizin. (Syn., Glycyrrh. Ammon.; Fr. Glycyrrhizine Ammoniacale; Ger. Ammoniak Glycyrrhizin.)

Manufacture: Macerate, percolate 100 Gm. with water 95 Ml. (Cc.) + ammonia water 5 Ml. (Cc.), proceeding with water alone q. s. 100 Ml. (Cc.); add sulphuric acid slowly, constantly stirring, wash well the precipitate, redissolve in water by aid of ammonia water, filter, add sulphuric acid so long as precipitate is produced, wash well, dissolve in enough diluted ammonia water, spread on glass to dry. It is in brownish-red scales, odorless, very sweet taste, soluble in water (freely), alcohol. *Tests:* 1. Heat aqueous solution with potassium hydroxide T. S.—ammonia evolved. 2. Supersaturate aqueous solution with an acid—precipitate (glycyrrhizin), which dissolved in hot water forms a jelly on cooling, that upon being washed with diluted alcohol and dried appears as an amorphous, yellow powder, having a strong, bitter-sweet taste, acid reaction. 3. Incinerate .5 Gm.—ash .5 p. c. Dose gr. 5–15 (.3–1 Gm.).

5. *Pulvis Glycyrrhizæ Compositus.* Compound Powder of Glycyrrhiza. (Syn., Pulv. Glycyrrh. Co., Compound Licorice Powder; Fr. Poudre pectorale de Réglisse composée; Ger. Pulvis Liquiritiæ compositus (Pectoralis Kurellæ), Brustpulver.)

Manufacture: Mix oil of fennel .4 Gm. with sugar 50 Gm., add glycyrrhiza 23.6 Gm., senna 18 Gm., washed sulphur 8 Gm.; mix thoroughly, pass through No. 80 sieve. It is greenish-yellow, fennel-like odor; microscopically—fragments of glycyrrhiza with yellow fibres, crystal fibres, large tracheæ, starch grains, .002–.02 Mm. $(\frac{1}{12500}-\frac{1}{1250}{}')$ broad; fragments of senna with non-glandular hairs, epidermis, stomata with 2 neighboring cells, crystal fibres; with potassium hydroxide T. S.—yellowish-red, changing to reddish-brown. Dose, ʒss–2 (2–8 Gm.).

6. *Massa Hydrargyri,* 10 p. c. 7. *Pilulæ Ferri Iodidi,* $\frac{3}{5}$ gr. (.04 Gm.). 8. *Tinctura Aloes,* 20 p. c.

Unoff. Preps.: Fluidglycerate, 100 p. c., + ammonia water 6, glycerine, 50, water q. s. *Aromatic Elixir,* 12.5 p. c. (fldext.), + oils of clove and cinnamon, each .075, oil of myristica .05, oil of fennel .15, purified talc 2, aromatic elixir q. s., dose, ʒj–2 (4–8 Ml. (Cc.)). *Aqueous Elixir,* 15 p. c. (fldext.). *Syrup.*—Macerate root (20) in water (100 + ammonia water 10) for 12 hours, boil, filter, evaporate to 10, add alcohol (10), let stand 12 hours, filter, add syrup q. s. 100 parts; or mix fluidextract (2) with syrup (8); or mix fluidglycerate 25, syrup q. s. 100. Dose, *ad libitum;* mostly for flavoring.

Properties.—Demulcent, expectorant, laxative; locally—slight stimulant. Increases, when chewed, the flow of saliva and mucus, which secretions are emollient to the throat.

Uses.—Febrile catarrhal conditions, bronchitis, bowel and urinary affections; here should be prepared with flaxseed, rice, barley, or gum water. In pharmacy used to mask taste of aloes, ammonium chloride, bitter sulphates, colocynth, guaiacum, hyoscyamus, mezereum, senega, senna, quinine, turpentine, etc. Mechanically as an excipient and dryer in pills, troches, etc.

Allied Plants:

1. *Glycyrrhiza echina'ta.*—Europe, Hungary, S. Russia; flowers in globular heads, pod ovoid with long spines. *G. lepido'ta;* United States (Mo., Minn.).

2. *A'brus precato'rius, Indian (Wild) Licorice, Jequirity,* India, Brazil.—Seeds used as standard weight, and for criminal poisoning, although inert when taken whole; contain *abrin,* having the action of snake-venom, being cardiac depressant; root contains glycyrrhizin, but is a poor substitute for licorice.

3. *Ono'nis spino'sa, Rest-harrow,* Europe.—Root .6 M. (2°) long, 12 Mm. ($\frac{1}{2}$′) thick; odor and taste similar to official licorice.

4. *Glyc'ine (So'ja) his'pida, Soja Bean.*—Japan, cultivated S. Asia; contains casein 40 p. c., fixed oil 15–20 p. c., dextrin 10, starch 5, cellulose 5, water 10, amylolytic ferment. Owing to the beans containing so little starch they are ground into flour, and made into bread for diabetic patients, in order to decrease sugar in the urine; plant—turned under as a nitrogeneous fertilizer to land.

SCOPARIUS. SCOPARIUS.

Sparteinæ Sulphas. Sparteine Sulphate, $C_{15}H_{26}N_2.H_2SO_4+5H_2O$, *official.*

Cytisus Scoparius, (*Linné*) *Link.* — The sulphate of sparteine, a liquid alkaloid from this plant.

Habitat. W. Asia, S. and W. Europe (W. Siberia, Great Britain)—sandy soil; naturalized in middle and southern United States; cultivated in gardens.

Syn. Broom, Green (Scotch, Common, Irish) Broom, Hagweed, Bannal; Spartein. Sulph.; Br. Scopari Cacumina, Broom Tops; Fr. Genêt à balais; Sulfate de Spartéine; Ger. Besenginster, Pfriemenkraut; Sparteinsulfat.

Cyt′i-sus. L. fr. G. *κύτισος*, classic name, after island of Cythrus, one of the Cyclades—*i. e.*, where first found growing.

Sco-pa′ri-us. L. fr. *scopæ*, twigs, shoots, a broom—*i. e.*, made of twigs, twiggy.

Plant.—Shrub 1.2–2.4 M. (4–8°) high; stem 2.5–5 Cm. (1–2′) thick, with many pentangular, green, flexible, wand-like branches in close fascicles—suitable for broom-making; leaves alternate, small, oblong, downy, trifoliate; leaflets sessile, 6–12 Mm. ($\frac{1}{4}$–$\frac{1}{2}$′) long, lanceolate; flowers May–June, many, large, racemes, brilliant yellow, papilionaceous; fruit pod, 4 Cm. ($1\frac{3}{5}$′) long, 6 Mm. ($\frac{1}{4}$′) broad, compressed, 12–18-seeded, entire plant with peculiar odor, nauseous taste. Tops, in thin flexible branched twigs, 2–3 Mm. ($\frac{1}{12}$–$\frac{1}{8}$′) thick, dark green, with 5 wings and numerous reddish-brown cork patches, internally yellowish, younger branches somewhat pubescent, fracture short fibrous, that of thick pieces tough, splintery, usually without leaves; odor peculiar when bruised; taste disagreeably bitter. Dose, gr. 15–30 (1–2 Gm.).

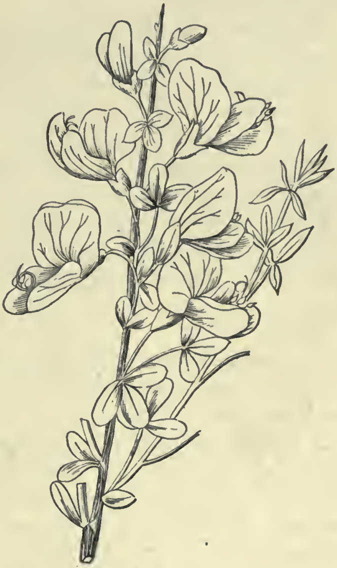


Fig. 201.—*Cytisus Scoparius:* flowering branch.

Constituents.—Sparteine .03 p. c., Scoparin (diuretic), volatile oil, tannin, fat, wax, sugar, ash 5–6 p. c.

Sparteinæ Sulphas. Sparteine Sulphate.—Obtained by exhausting plant with acidulated (H_2SO_4) water, distilling concentrated infusion with sodium hydroxide, neutralizing the liquid sparteine (10) with 10 p. c. sulphuric acid (40), crystallizing. It is in colorless, rhombohedral crystals, crystalline powder, odorless, slightly saline, bitter taste, hygroscopic, soluble in water (1.1), alcohol (3), insoluble in chloroform, ether; aqueous solution (1 in 20) neutral or acid. *Tests:* 1. Add to

.1 Gm., in test-tube, 25 Ml. (Cc.) of ether, a few drops of diluted ammonia water, then ethereal solution of iodine (1 in 50) until mixture, when shaken, turns from orange to reddish-brown; minute greenish-brown crystals soon coat sides. 2. Aqueous solution with barium chloride T. S.—white precipitate, insoluble in hydrochloric acid; incinerate 1 Gm.—ash .1 p. c. *Impurities:* Ammonium salts, aniline, readily carbonizable organic substances. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{6}$–$\frac{1}{2}$ (.01–.03 Gm.).

Properties.—Cardiac stimulant, narcotic; large doses paralyze respiratory and motor centres, causing convulsions and death by asphyxia; normal doses strengthen heart-beats, slow the rate (acting directly on cardiac muscle and inhibitory apparatus); may quicken heart when abnormally slow, acting as a regulator; action lasts 6–8 hours.

Uses.—Cardiac affections, palpitation; inferior to digitalis, although it has the advantage of quicker action (within 20 minutes) and no cumulative effect.

Poisoning: Similar to digitalis. Give strychnine, atropine, electricity (respiration), tannin, potassium iodide, diuretics, diluents.

Incompatibles: Tannic acid, potassium iodide.

Synergists: Digitalis, strophanthus, etc.

Dried Tops, official 1830–1910. More or less popular also for diuretic glucoside, scoparin, $C_{21}H_{22}O_{10}$, pale yellow crystals, amorphous powder, soluble in water, dose, gr. 1–10 (.06–.6 Gm.); may use fluidextract (diluted alcohol), dose, ʒss–1 (2–4 Ml. (Cc.)); decoction, 5 p. c., ℥j–2 (30–60 Ml. (Cc.)); infusum scoparii (Br.), 10 p. c., ℥j–2 (30–60 Ml. (Cc.)); succus scoparii (Br.), 75 p. c., + alcohol 25, ʒj–2 (4–8 Ml. (Cc.)).

Allied Plants:

1. *Spar'tium jun'ceum, Spanish Broom.*—Leaves soft, hairy; seeds reniform, properties similar to *Cytisus Scoparius;* fibres used for cordage, coarse cloth, etc.

2. *Baptis'ia tincto'ria, Baptisia, Wild (False) Indigo.*—The whole plant, official 1830–1840; root now used; N. America. Plant .6–1 M. (2–3°) high, smooth, succulent, glaucous, disagreeable odor when bruised—repellent to insects, etc.; flowers yellow; root (most active), fleshy, .5–4 Cm. ($\frac{2}{5}$–1$\frac{3}{5}$′) thick, usually cut into elongated, cylindrical pieces; crown 5–8 Cm. (2–3$\frac{1}{5}$′) thick, warty, with stem scars; dark brown, wrinkled; fracture tough, whitish; taste bitter, acrid, nauseous; contains cytisine (baptitoxine—acrid, poisonous), baptisin (non-active bitter glucoside), baptin (purgative glucoside), ash 5 p. c.; used as a stimulant for scarlatina, typhus, dysentery; locally—aphthæ, ulcers, etc.; in decoction, infusion, fluidextract (75 p. c. alcohol), tincture. Dose, gr. 5–15 (.3–1 Gm.); baptisin gr. 2–6 (.13–.4 Gm.); large doses emetic, cathartic—death by respiratory paralysis.

ARAROBA. GOA POWDER.

Chrysarobinum. Chrysarobin, $C_{30}H_{26}O_7$, *official.*

Vouacapoua Araroba, *(Aguiar) Druce.*	A mixture of neutral principles extracted from Goa Powder, a substance found deposited in the wood of this plant.

Habitat. Brazil, Bahia; in damp forests.

Syn. Araroba or Arariba Tree, Po(h)de Bahia, Crude Chrysarobin; Chrysarob.; Fr. Poudre de Goa, Chrysarobine; Ger. Goa Pulvre, Chrysarobin.

Vou-a-ca-pou'a. L. fr. native C. American name (nomen caribæum), *voicapou.*

Ar-a-ro'ba. L. fr. E. India name, *ar(ar)oba*, as applied to the bark.

Chrys-ar-o-bi'num. L. for *Chry-sar'o-bin*, fr. Gr. χρυσός, gold, + *ar(ar)oba.*

Go'a. After Portuguese colony of Goa, on the Malabar coast of India, to which it was imported from Bahia, in Brazil, 1852.

PLANT.—Large tree 24–30 M. (80–100°) high; trunk smooth, spheroidal, head not very bushy; leaves paripinnate, with long petioles; flowers purple, paniculate racemes; wood yellow, with numerous longitudinal canals and many irregular transverse interspaces or lacunæ in which the Goa Powder is found—a result of decay or chemical changes in the cell-walls of the trunk-wood (medullary rays), being possibly an antiseptic preservative of the plant; yields much chrysophanic acid by oxidation.

Commercial.—Tree resembles the copaiba, and is called natively *Angelim Amargoso;* the oldest yield most powder, which is obtained by felling, splitting the tree, and then scraping the powder from the clefts, those doing this often suffering with irritated eyes and face; occurs as a light yellow powder when fresh, but brownish on exposure, slightly crystalline, rough, mixed with wood fibres, inodorous, bitter; 7 p. c. soluble in water, 80 p. c. in benzene, 50 p. c. in hot chloroform.

CONSTITUENTS.—GOA POWDER: Chrysarobin 65–85 p. c., gum 7 p. c., resin 2 p. c., bitter extractive 7 p. c., woody fibre 5 p. c., ash .3–3 p. c.

Chrysarobinum. Chrysarobin.—Obtained by treating Goa Powder with hot benzene (hot chloroform), evaporating to dryness, powdering. It is a brownish, orange-yellow, micro-crystalline powder, tasteless, odorless, irritating mucous membrane, soluble in alcohol (385), chloroform (12.5), ether (16), benzene (30), carbon disulphide (180), solutions of fixed alkali hydroxides (red), slightly in water and boiling water; contains methyl chrysarobin in varying percentage, and is a reduced quinone. *Tests:* 1. Dissolve in sulphuric acid—deep red solution, which poured into water deposits chrysarobin unchanged. 2. Incinerate .5 Gm.—ash .25 p. c.; shake 1 Gm. with potassium hydroxide T. S. (10)—yellow, yellowish-red, deep red, due to absorbing oxygen from the air, producing chrysophanic acid—$C_{30}H_{26}O_7 + O_4 = 2C_{15}H_{10}O_4 + 3H_2O$, or inversely—$2C_{15}H_{10}O_4 + H_8 = C_{30}H_{26}O_7 + H_2O$. 3. Mix .001 Gm. with 2 drops of fuming nitric acid—red mixture, turning violet-red with a few drops of ammonia water (dist. from chrysophanic acid

—yellow liquid). Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$ (.008 Gm.).

Preparation.—1. *Unguentum Chrysarobini.* Chrysarobin Ointment. (Syn., Ung. Chrysarobin.; Fr. Pommade de Chrysarobine; Ger. Chrysarobinsalbe.)

Manufacture: 6 p. c. Triturate chrysarobin 6 Gm. with benzoinated lard 94 Gm. previously melted, heat on water-bath for 20 minutes, stirring occasionally, strain (thereby removing about 1 p. c.), stir until congealed.

Properties.—Irritant, in doses of gr. 20 (1.3 Gm.) gastro-intestinal irritant, causing large watery, bilious stools, vomiting, nausea. Externally—produces diffuse dermatitis, followed by follicular and furuncular inflammation; stains skin dark brown, removed by chlorinated lime.

Uses.—Parasitic skin diseases of vegetable origin, ringworm, acne, favus, psoriasis, chronic eczema, hemorrhoids.

Allied Compounds:

1. *Anthrarobin* (*Desoxyalizarin*), $C_{14}H_{10}O_{13}$.—Obtained from the coal-tar product alizarin by action of nascent hydrogen; it is a strong deoxidizing agent, miscible with fats, weaker, less irritating and toxic than chrysarobin, soluble in alcohol, glycerin.

2. *Hydroxylamine Hydrochloride,* NH_2OHHCl.—This does not stain the skin, hence is preferred often to the other reducing agents (chrysarobin, pyrogallol, anthrarobin, etc.) in skin diseases, but being a poison, care should be exercised not to allow too much to be absorbed by the system.

PHYSOSTIGMA. PHYSOSTIGMA.

Physostigma venenosum, *Balfour.* { The dried ripe seeds, containing .15 p. c. of alkaloids.

Habitat. W. Africa (near mouths of Niger and Old Calabar Rivers, in the Gulf of Guinea); introduced into India and Brazil.

Syn. Physostig. Calabar Bean, Ordeal Bean, Chop Nut, Split Nut; Physostigmatis Semina; Fr. Fève de Calabar; Ger. Faba Calabarica, Kalabarbohne.

Phy-so-stig'ma. L. fr. Gr. φύσα, a bladder, + στίγμα, stigma—*i. e.*, stigmatic appendage is hollow and inflated.

Ven-e-no'sum. L. *venenosus,* full of poison, poisonous—*i. e.*, plant's property.

Cal'a-bar Bean—*i. e.*, bean from the Calabar district on W. African coast.

Plant.—Woody, perennial climber; stem 12–15 M. (40–50°) long, 5 Cm. (2′) thick, smooth; root spreading, fibrils many, having attached small succulent tubers; leaves large, pinnately trifoliate, leaflets 7.5–15 Cm. (3–6′) long, stipulate, ovate pointed; flowers purplish, racemes; fruit June–Sept., legume 10–17.5 Cm. (4–7′) long, compressed, pointed, pale brown, 2-valved, reticulately veined, dehiscent, inside woolly, 2–3-seeded. Seeds, oblong, ellipsoidal, somewhat compressed reniform, 15–30 Mm. ($\frac{3}{5}$–1$\frac{1}{5}$′) long, 10–15 Mm. ($\frac{2}{5}$–$\frac{3}{5}$′) broad, 12 Mm. ($\frac{1}{2}$′) thick, reddish, chocolate-brown, smooth, somewhat wrinkled near brownish-black groove, the latter being 2 Mm. ($\frac{1}{12}$′)

wide, and extending almost the entire length of convex edge and in which often are found remains of white membranous funiculus, margins of seed-coat on both sides of the groove somewhat elevated, yellowish-red, brownish-red and thickened; embryo large, white, with short hypocotyl and 2 concavo-convex cotyledons; taste at first starchy, afterward acrid. POWDER, grayish-white; microscopically—numerous starch grains, .005–.15 Mm. ($\frac{1}{5000}$–$\frac{1}{170}$′) broad, fragments of seed-coat with thick cells resembling stone cells, occasional fragments with tracheæ. Embryo 72 p. c., integuments 28 p. c., the former when moistened with potassium hydroxide T. S. becoming pale yellow. *Solvent:* alcohol. Dose, gr. 1–4 (.06–.26 Gm.).

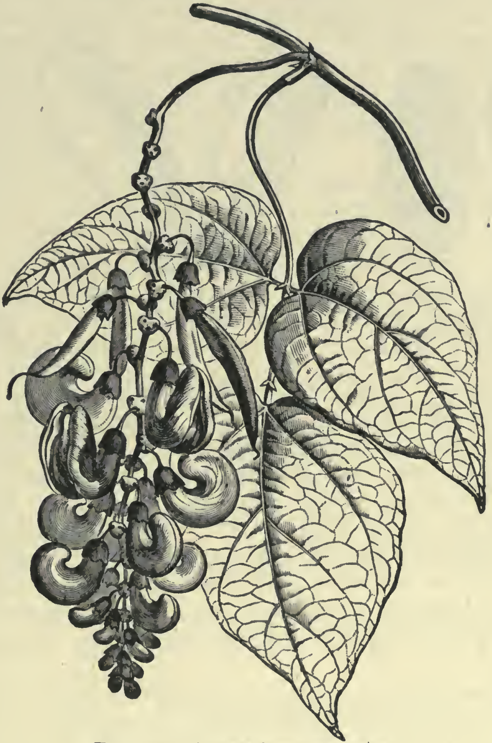


FIG. 202.—*Physostigma venenosum.*

ADULTERATIONS.—*P. cylindrosper'ma*, seeds 4 Cm. (1$\frac{3}{5}$′) long, nearly cylindrical, groove and hilum shorter, not extending quite to the end; *En'tada scan'dens*, seeds round, flat, 5 Cm. (2′) broad (poisonous), also *Oil Palm Seeds*, and seeds of *Mucuna* species, none of which resemble the official.

Commercial.—Plant first noticed medicinally in 1846, and, except ligneous stem, resembles our String and Lima Beans (*Phase'olus multiflo'rus* and *P. luna'tus*), preferring banks of streams into which the fruit often falls only to be dispersed and conveyed to settlers more or less remote.

Constituents.—Physostigmine (eserine) .1 p. c., Eseridine, eseramine, $C_{16}H_{25}N_4O_3$ (crystalline physiologically inactive), calabarine (liquid, not yet obtained pure, antagonistic to physostigmine, tetanic, may cause diarrhœa and convulsions, soluble in alcohol, water, insoluble in ether), phytosterin—separable into sitosterin 80 p. c., stigmosterin 20 p. c., which crystallizes with 1 molecule of H_2O, inactive, starch 48 p. c., proteids (albumin) 23 p. c., gum, fat, ash 3–4 p. c.

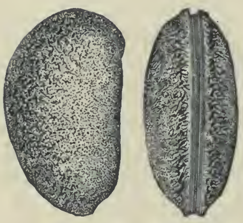


Fig. 203.—Physostigma: view from the side and edge, showing length of hilum.

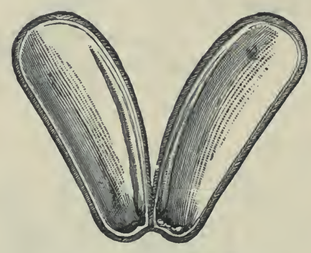


Fig. 204.—Physostigma split, showing cotyledons.

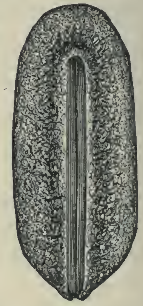


Fig. 205.—*Physostigma cylindrosperma.*

Physostigmine, $C_{15}H_{21}N_3O_2$.—Chiefly in embryo; obtained by mixing powdered bean with 1 p. c. of tartaric acid, exhausting with alcohol, evaporating, treating residue with water, agitating filtrate with ether to remove color, adding sodium bicarbonate, shaking with ether, evaporating, getting colorless, amorphous physostigmine; hygroscopic, liquefies at 45° C. (113° F.), tasteless, soluble in alcohol, ether, chloroform, benzene, carbon disulphide, slightly in water; forms salts (benzoate, citrate, hydrobromide, hydrochloride, nitrate, etc.). With alkalies of chlorinated lime yields red *rubreserine;* with sulphuric acid gives yellow, then olive-green. Dose, gr. $\frac{1}{120}-\frac{1}{60}$ (.0005–.001 Gm,).

Physostigminæ Salicylas, Physostigmine Salicylate. $C_{15}H_{21}N_3O_2.C_7H_6O_3$, *official.*—(Syn., Physostig. Salicyl., Eserine Salicylate; Fr. Salicylate d'Ésérine; Ger. Physostigminum salicylicum, Physostigminsalicylat.) Obtained by neutralizing alcoholic or ethereal solution of physostigmine with salicylic acid, allowing to crystallize; it is in colorless, faintly yellowish, shining, acicular, or short columnar crystals, odorless, acquiring red tint on exposure (must use great caution in tasting); soluble in water (75), hot water (16), alcohol (16), hot alcohol (5), chloroform (6), ether (250); cold, saturated aqueous solution neutral or faintly acid, usually pink in 24 hours, greatly hastened by a few drops of sodium hydroxide T. S. *Tests:* 1. Aqueous solution with ferric chloride T. S.—deep violet color; with solution of chlorinated lime—red color. 2. Evaporate .005 Gm. to dryness with a few drops of ammonia water—blue residue, which dissolved in alcohol, + acetic acid in excess—red, fluorescent solution; incinerate .1 Gm.—ash non-weighable. *Impurities:* Sulphate, readily carbonizable substances. Should be kept dark, in small, well-closed containers. Dose, gr. $\frac{1}{120}$–$\frac{1}{60}$ (.0005–.001 Gm.).

Eseridine, $C_{15}H_{23}N_3O_3$.—Derivative of physostigmine, from which it differs by containing H_2O, and into which it can be converted by dilute acids; obtained from its mother-liquor by precipitating with lead subacetate and ammonia, evaporating filtrate, treating residue with alcohol, precipitating with phosphotungstic acid, decomposing with baryta; occurs in 4-sided crystals, soluble in alcohol, chloroform, ether, acts similar to physostigmine. Dose, gr. $\frac{1}{20}$–$\frac{1}{10}$ (.003–.006 Gm.).

PREPARATIONS.—1. *Extractum Physostigmatis.* Extract of Physostigma. (Syn., Ext. Physostig., Powdered Extract of Physostigma; Fr. Extrait de Fève de Calabar; Ger. Extractum Fabæ Calabaricæ, Kalabarbohnenextrakt.)

Manufacture: Macerate, percolate 100 Gm. with 75 p. c. alcohol 100 Ml. (Cc.) + tartaric acid .5 Gm., proceed with 75 p. c. alcohol until exhausted, reclaim alcohol, evaporate residue at 70° C. (158° F.) to 20 Ml. (Cc.), transfer to a flask, rinse still with little warm 75 p. c. alcohol, which add to flask, + water 10 Ml. (Cc.) + purified petroleum benzin 25 Ml. (Cc.), shake thoroughly several minutes, decant benzin layer, again shake residue with purified petroleum benzin 20 Ml. (Cc.), discard benzin layers, transfer residue to a dish, rinse flask with little warm 75 p. c. alcohol, which add to dish, evaporate at 70° C. (158° F.) to pilular consistence, incorporate thoroughly dried starch 2 Gm., expose to warm air until dry, pulverize; after assay add enough dried starch for the extract to contain 2 p. c. of the alkaloids; mix thoroughly, pass through fine sieve; contains 1.7–2.3—2 p. c. of the alkaloids; 1 Gm. represents about 13 Gm. of the drug. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. $\frac{1}{10}$–$\frac{1}{2}$ (.006–.03 Gm.).

2. *Tinctura Physostigmatis.* Tincture of Physostigma. (Syn., Tr. Physostig., Tincture of Calabar Bean; Fr. Teinture de Fève de Calabar; Ger. Kalabarbohnentinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: alcohol—percolate 95 Ml. (Cc.), assay, and add enough menstruum for the 100 Ml. (Cc.) to contain .013–.017—.015 Gm. of the alkaloids. Dose, ♏v–20 (.3–1.3 Ml. (Cc.)).

Unoff. Prep.: Lamellæ Physostigminæ (Br.), $\frac{1}{1000}$ gr. (.00006 Gm.).

PROPERTIES.—Sedative, myotic, motor depressant, paralyzant, emetic, purgative, diaphoretic, sialagogue, poisonous. Stimulates salivary, gastric, and intestinal secretions, peristalsis, acting directly upon the unstriped muscle-fibres, quickens breathing, then retards it, heart becomes slow and irregular, but more powerful, finally feeble and ceasing altogether, depresses, ultimately paralyzes spinal cord reflex, and motor centres.

USES.—Tetanus, chorea, epilepsy, progressive paralysis, tonic convulsions, gastralgia, strychnine and atropine poisoning, constipation (combined with belladonna and nux vomica). Externally—in neuralgia, muscular rheumatism, malignant tumors. Physostigmine ($\frac{1}{2}$ p. c. in water, few drops into eye) for breaking up ocular adhesions (iris, cornea, lens), lessen intra-ocular tension, iritis, corneal ulcers, prolapsed iris, paralysis of the iris accommodation following diphtheria, glaucoma. In Africa as *ordeal bean* of Calabar for punishing criminals and for witchcraft, the accused having to eat them until they vomit or die: if former, innocent; latter, guilty (?). A paste of 20 seeds will kill.

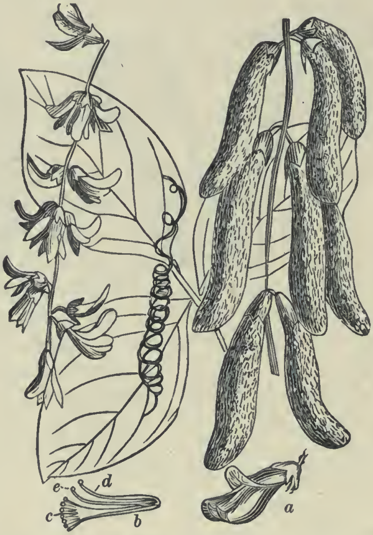


FIG. 206.—*Mucuna pruriens: a*, flower; *b*, stamen system; *c*, anthers; *d*, filament; *e*, anther.

Poisoning: Have nausea, giddiness, abdominal pain, indistinct vision, diminished heart action, muscular tremors and weakness, then complete relaxation, retarded respiration, motor paralysis, sphincters contract, cold extremities, skin covered with cholera-like sweat. Conscious until death, which is caused by carbon dioxide narcosis, and paralysis of the respiratory centres and heart-muscle. Evacuate stomach (emetics, pump); give atropine (physiological antidote) hypodermically, gr. $\frac{1}{30}$ (.002 Gm.); tannin, hydrated chloral (spine), strychnine, diffusible stimulants, coffee, ammonia, digitalis, alcohol, artificial heat and respiration, electricity. Empty bladder often (catheter), as the drug is eliminated by kidneys (bile and saliva), and urine becomes poisonous.

Incompatibles: Vegetable astringents, tannin, caustic alkalies, atropine, hydrated chloral, motor and tetanizing excitants.

Synergists: Motor depressants, conium, gelsemium, amyl nitrite, etc.

Allied Plants:

1. *Mucu'na pru'riens, Cowhage, Cowitch.*—Hairs of the pods, official 1820–1880; E. and W. Indies. Climbing plant, flowers resemble those of the pea, purple; leaflets hairy; pods coriaceous, shape of italic letter *f*, 10 Cm. (4′) long, covered with brown hairs, 2.5 Mm. ($\frac{1}{10}$′) long, stiff, filled with brown granular matter, readily penetrating the skin, causing violent itching. Detached from pods (which then are eaten as also when green in India) by dipping into honey, scraping into paste; contains resin, tannin. Used as anthelmintic for round worms; irritant in paralysis; action on worms thought to be mechanical. Dose, gr. 1–3 (.06–.2 Gm.), followed by calomel, jalap; ointment also used.

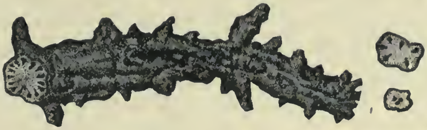


FIG. 207.—*Geranium maculatum:* rhizome and transverse section of rhizome and root, natural size.

2. *Gera'nium macula'tum, Wild (Spotted) Cranesbill.*—Geraniaceæ. The dried rhizome, official 1820–1910; N. America, rich woods, thickets. Perennial, hairy herb, .3–.6 M. (1–2°) high; leaves palmately 5–7-lobed, each lobe incised at apex, cuneate, hairy, pale green with paler spots; flowers large, purplish, umbels; petals 5, entire; fruit long-beaked. Rhizome, cylindraceous, 2.5–10 Cm. (1–4′) long, 3–15 Mm. ($\frac{1}{8}$–$\frac{3}{5}$′) thick, sharply tuberculated, dark brown, fracture short, brownish, purplish, bark thin; wood-wedges yellowish, cambium dark, pith large; odor slight; taste strongly astringent; solvents: alcohol, water; contains tannin 10–28 p. c., gallic acid, resin, crystalline principle, geranium-red, a phlobaphene formed from the tannin, ash 8 p. c. Astringent, tonic; diarrhœa, chronic dysentery, hemorrhages, gleet, leucorrhœa, aphthæ, relaxed vagina, throat, uvula, rectum, indolent ulcers. Dose, gr. 15–60 (1–4 Gm.; decoction (made with water or milk); extract; fluidextract (glycerin 10, alcohol 60, water 30), ℥ss–1 (2–4 Ml. (Cc.)); tincture; "Eclectic" geranin.

3. *G. Robertia'num.*—Europe; popular astringent for hemorrhages, diuretic for gravel. *Ero'dium (Geranium) moscha'tum, Stork's-bill;* diaphoretic. *E. cicuta'rium, Heron's-bill;* diuretic for dropsy.

36. LINACEÆ. Flax Family.

Li-na'se-e. L. *Lin-um* + aceæ, flax, fr. Celtic *llin*, a thread, whence Gr. λίνον, L. *linum* (classic names), Eng. linen—*i. e.*, its fabric. Herbs. Distinguished by flowers being regular; stamens 5, monadelphous at base; sepals 5, imbricate, petals 5; ovary 2–5-celled, styles 2–5; fruit capsular, seeds 2 in each cell, albuminous, superior, universal; temperate climates; demulcent, purgative, stimulant, sedative, tonic; fibres, oil.

Genus: **1. Linum.**

LINUM. LINSEED.

Linum usitatissimum, *Linné.* { The ripe seeds, with not more than 3 p. c. of other seeds, foreign matter.

Habitat. C. Asia, Egypt, S. Europe, spontaneous in most temperate countries; cultivated in Russia, Egypt, India, United States, S. Europe, England, Holland.

Syn. Flaxseed, Flax, Lint-bells, Winter lien; Br. Lini Semina, Lini Semina Contusa (Crushed); Fr. Lin, Semence (Graine) de Lin; Ger. Semen Lini, Leinsamen, Flachssamen.

Li'num. L. see etymology, page 325, of Linaceæ.

U-si-ta-tis'si-mum. L. sup. adj. fr. *usitatus*, most useful, common, familiar.

Flax'seed. AS. *fleax, flechten,* to braid, plait, twist—*i. e.,* its fibres, + *seed.*

Plant.—An annual; stem .6 M. (2°) high, stiff, erect, solitary, round, smooth, green; leaves small, lanceolate, acute, entire, sessile, pale green, 2–4 Cm. ($\frac{4}{5}$–$1\frac{3}{5}$′) long; flowers June–July; terminal, bluish; fruit August, globular capsule, size of pea, with persistent calyx at base, crowned with sharp spine, 10-seeded in distinct cells. Seeds, ovate, oblong-lanceolate, flattened, obliquely pointed at one end, 3–5 Mm. ($\frac{1}{8}$–$\frac{1}{5}$′) long; chestnut-brown, very smooth and shiny, raphe a distinct, light yellow ridge along one edge, easily cut with finger-nail; internally olive-green; oily; odor slight; taste mucilaginous, oily. Powder, light brown; microscopically—large oily globules and irregular fragments of endosperm and seed-coat, the latter characterized by pigment cells with brownish content and stone cells with yellowish walls; mounts in fat-free sample show aleurone grains. Ground (linseed (flaxseed) meal, lini farina, crushed linseed), light olive-brown, with reddish-brown very coarse fragments; both degrees of fineness must be free from unpleasant or rancid odor. *Tests:* 1. Boil 1 Gm. fat-free (seeds, powder, meal) with water 50 Ml. (Cc.), cool—filtrate + iodine T. S. not more than faint blue color (abs. of starch). 2. Extract (powder) with purified petroleum benzin—yields 30 p. c. of fixed oil, of which 98 p. c. is saponifiable. *Solvent:* boiling water. Dose, ʒj–2 (4–8 Gm.).

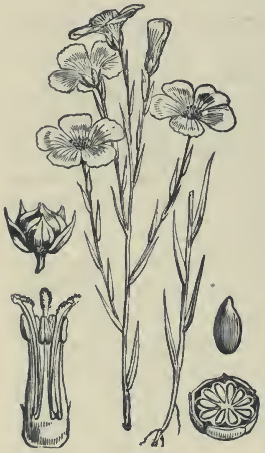


Fig. 208.—*Linum usitatissimum.*

Adulterations.—Seeds: Foreign seeds and earthy matter 1–25 p. c.—mustard, rape and other cruciferous seeds, sand, small stones; Powder: Damaged flour, cornmeal, other starchy substances, recognized by microscope or iodine test; expressed cake and that to which mineral oil has been added.

Commercial.—The flax is of ancient origin, being prized for its fabric and medicinal properties; most of our seeds now come from Russia and Germany, but the United States furnishes considerable. When exposed to heat, light, damp atmosphere, or otherwise carelessly preserved, especially the ground, it is subject to insect attack, and should not be used after 1 year old.

Constituents.—Fixed oil 35–40 p. c. (in nucleus), Mucilage, $C_{12}H_{20}O_{10}$, 15 p. c. (in integuments—viscid, odorless, nearly tasteless, precipitated by alcohol, lead subacetate, but not by tannin), proteids 25 p. c., tannin, amygdalin (resin, wax, sugar, no starch (except in young seeds), ash 4–6 p. c.—phosphates, sulphates, chlorides of potassium, calcium, magnesium).

Oleum Lini. Linseed Oil. *official.*—(Syn., Ol. Lini, Oil of Flaxseed, Raw Linseed Oil; Fr. Huile de Lin; Ger. Leinol, Leinsamenöl.) This fixed oil, usually obtained by drying the seeds with heat, crushing, and expressing, is a yellowish, oily liquid, peculiar odor, bland taste; gradually thickens and darkens on exposure, acquiring a strong odor and taste; slightly soluble in alcohol, miscible with ether, chloroform, petroleum benzin, carbon disulphide, oil of turpentine; slightly acid; sp. gr. 0.930, congeals at —20° C. (—4° F.); consists of liquid glycerides of oleic acid, $C_{18}H_{34}O_2$ (5), linoleic acid, $C_{18}H_{32}O_2$ (15), linolenic acid, $C_{18}H_{30}O_2$ (15), and isolinoleic acid, $C_{18}H_{32}O_2$ (65) 85–90 p. c., also a mixture of palmitin, myristin, and stearin 10–15 p. c.; also claimed to consist chiefly of linolic acid, 22–25 p. c. of linolenic acid, and 5 p. c. of fatty acids; 1 p. c. of non-saponifiable matter. Linolein, the glyceride of linoleic acid, is considered the drying constituent, which on exposure is converted into oxylinoleic acid hydrate, and finally into linoxyn, $C_{32}H_{54}O_{11}$ (insoluble in ether, and soon forms in the boiled oil). Yield by cold process 16–20 p. c., by heat 25–28 p. c., the latter being darker, with stronger odor and more acid taste. *Impurities:* Free acid, non-drying oils, mineral or rosin oils, rosin, Should be kept in well-stoppered containers, and that which has been "boiled" must not be used nor dispensed. Dose, ℥ss–2 (15–60 Ml. (Cc.)).

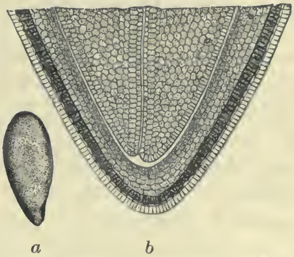


Fig. 209. — Flaxseed: *a*, entire, magnified 3 diam.; *b*, transverse section near the edge, magnified 65 diam.

Preparations.—Oil: 1. *Linimentum Calcis*, 50 p. c. 2. *Liquor Cresolis Compositus*, 30 p. c.

Unoff. Preps.: Seeds. *Infusion*, 5 p. c. *Compound Infusion*, 5 p. c., + licorice root 2 p. c. These were once official and are effective from the dissolved mucilage of the epithelium (testa), which is altered starch. Dose, *ad libitum*. *Decoction*, 5 p. c. *Poultice*.

Properties.—Demulcent, emollient, diluent, diuretic.

Uses.—*Infusion* or tea for inflammation of mucous membranes of respiratory, digestive, and urinary organs, renal and vesical irritation, catarrh, dysentery, calculi, strangury. *Decoction*, owing to the oil it contains, is less acceptable to the mouth, but all the better for enema.

Poultice of ground meal to enlarged glands, swellings, boils, pneumonia, etc., made by adding boiling water to meal for proper consistency and bringing to a boil. Should coat skin with glycerin, olive or other oil before applying, and place as near to affected spot as possible; may cover with oiled silk to retain heat and moisture, and may add olive oil, lard, laudanum or any anodyne, stimulating, or astringent solution to poultice. The oil is laxative (℥j; 30 Ml. (Cc.)), excellent in piles (℥j–2; 30–60 Ml. (Cc.) night and morning); sometimes it is added to purgative enemata, also to cover erysipelatous and irritated skin surfaces, but with the disadvantages of soon drying (thus rendering skin stiff) and becoming sour and irritating. The *linimentum calcis* is applied to recent burns to allay irritation.

Allied Products:

1. *Flaxseed Cake, Oil-cake.*—Flaxseed when ground yields cake-meal, and this, after being deprived of oil, becomes oil-cake; it still contains all of the nitrogen, 4–5 p. c., and, moreover, a little oil, thus serving well as a cattle food; yields ash 5–8 p. c.

2. *Boiled Linseed Oil.*—Obtained by heating oleum lini to 130° C. (266° F.), while passing a current of air through it, when it boils, losing 6–8 p. c. by weight; or may heat and add litharge, red lead, manganese dioxide, lead acetate or manganous borate, thereby increasing the oil's weight and drying properties. It is darker in color, thicker, sp. gr. 0.939–0.950, and dries faster, hence useful in painting, varnishing, etc., but must never be used in liniments as a substitute for the official ("raw") oil, since irreparable injury (from forming crusts) might be occasioned to burns, etc., in removing dressings.

3. *Flax Liber-fibres.*—These furnish linen, which, when scraped, gives lint, while the primitive short fibre is useful as tow.

37. ERYTHROXYLACEÆ. Coca Family.

Er-i-throx-sil-a′se-e. L. *Erythroxyl-on* + aceæ, fr. Gr. *ερυθρός*, red, + *ξύλον*, wood—*i. e.*, some species have red wood. Shrubs, trees. Distinguished by flowers regular, small, calyx 5-lobed, petals 5, stamens 10, ovary 1–3-celled, superior; fruit drupe; temperate climates, tropics; stimulant, tonic, narcotic, dye.

Genus: **1. Erythroxylon.**

COCA. COCA.

Cocaina. Cocaine, *official*.

Erythroxylon Coca, *Lamarck*, and its varieties.	An alkaloid from the leaves.

Habitat. Peru, Bolivia, Ecuador—eastern slopes of the Andes (Colombia, Brazil, India, Ceylon, Java); cultivated.

Syn. Erythroxylon, Spadic, Coca leaves, Cuca, Hayo, Ipado, Coca Folia; Fr. Feuilles de Coca; Ger. Kokablätter; Cocain, Methyl-benzoyl-ecgonine; Br. Cocaina; Fr. Cocaine; Ger. Cocaïnum, Kokaina.

ERYTHROXYLACEÆ

Plant.—Shrub 1–2 M.(3–6°) high, with many spreading, purplish-brown branches, wrinkled bark, smooth twigs; flowers small, yellow, petals 5; stamens 10; fruit reddish drupe, oval, 12 Mm. ($\frac{1}{2}$′) long, sarcocarp scanty; leaves oval-elliptical, 2.5–7.5 Cm. (1–3′) long, 2–4 Cm. ($\frac{4}{5}$–1$\frac{3}{5}$′) broad, greenish-brown or clear brown, smooth, slightly glossy and coriaceous, shortly petioled, base short and abruptly narrowed, entire, midrib prominent underneath, with conspicuous line of collenchyma tissue running longitudinally on either side, one-third the distance between it and the margin, the enclosed areola of slightly different color; odor characteristic; taste bitterish, faintly aromatic, followed by numbness of tongue, lips, and fauces; powder yellowish-green. Dose, gr. 15–60 (1–4 Gm.).

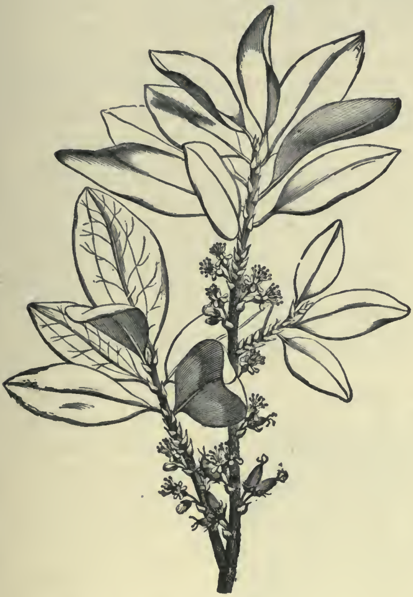


Fig. 210.—*Erythroxylon Coca.*

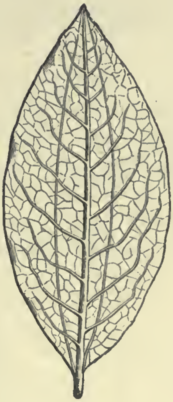


Fig. 211.—Coca leaf: under side, usual size.

Adulterations.—Leaves that are smudgy brown or with dull surface, also small jaborandi leaves, sometimes 40–50 p. c.; Inga and Pacay flowers by accident.

Commercial.—Coca, although not introduced into England until 1870, was used in S. America prior to the Spanish conquest, 1569, by the aborigines, who extolled it as a God-given plant ("The Divine Plant of the Incas") that satisfied hunger, strengthened the weak, and banished man's misfortunes; but the invaders, intolerant of such homage forbade its use and cultivation until they observed that it enabled the conquered to perform better work and service. Previous to 1884 the alleged properties were thought legendery and imaginative, when, being considered simply a mild stimulant like tea, Koeler proclaimed its local anæsthetic power. Species differ when wild and under cultivation, and escaping this soon degenerate and show marked changes in leaf-characteristics. It is cultivated extensively in the Andes on terraced plantations, *cocales*, cleared from the forests on the warm declivities, thriving best in a moist atmosphere amid scattered trees, but not deep shade, which, as well as low elevation, develops bitterness, consequently any variation in this or in the prescribed soil, exposure, and curing may affect quality. Propagation is similar to our peach, yielding leaves the second year and continuing for fifty thereafter. Leaves when bright green above and yellow-green below are picked carefully to avoid breaking, or injuring young leaf-buds that form the next crop, removed in baskets, spread on unroofed floors, and dried quickly for a few hours in the sun, if too rapidly losing odor and green color, if too slowly acquiring disagreeable odor and taste; after remaining 2–3 days in the coca-house, in loose piles, they are exposed again for a short time to the sun, to drive off developed sweat, and then compressed into bales (*cestos*), 25–50 pounds; 11.6–23.3 Kg., or better,

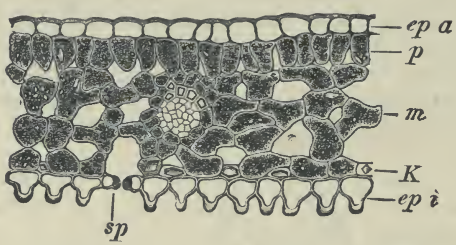


FIG. 212.—Coca leaf, cross-section: *ep a*, upper epidermis; *p*, palisade layer; *m*, spongy parenchyma (in the centre a small fibrovascular bundle); *K*, a crystal, magnified 160 diam.; *ep i*, epidermis of lower side with papilla and a stoma (*sp*).

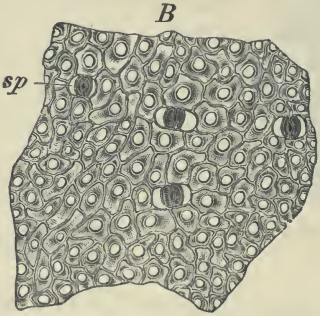


FIG. 213.—Coca leaf: Epidermis of lower side with the papillæ and stomata seen from above, magnified 160 diam.

tin-lined boxes that prevent likely deterioration in shipping through fermentative decomposition. Irrespective of the care in drying and keeping impairment begins at once, cocaine decreasing materially, especially in dampness, owing to which they should be discarded after a few months. Although in some localities collection is almost continuous there are at least 2–3 yearly harvests, the September being best, the April next, each yielding when dried 60–80 pounds (27–37 Kg.) per acre; the annual production is about 80,000,000 pounds (37,383,177 Kg.), exported largely from Huanuco, Lima, Truxillo, etc. There are two varieties: 1, *Huanuco* (*Cuzco—E. Coca*, short-styled), after cities of S. Peru, has best aroma, most cocaine, and less isotropyle-cocaine; grown mostly in Bolivia, S. Peru, thriving and yielding maximum product at 1,050–1,800 M. (3,500–6,000°), in 18° south, and inferior grades at lower elevations; the true Bolivian (*E. bolivia'num*, long-styled) is prized most highly, has larger fruit, smaller leaves, and owing to home demand seldom is exported; 2, *Truxillo* (*Trujillo—E. truxillense*, short-styled), leaves ovate-oblanceolate, 1.6–5 Cm. ($\frac{2}{3}$–2′) long, one-half as broad, pale green, thin, brittle, usually much broken, smooth, shining, petiole short and stout, slight point at apex, entire, the two collenchyma lines underneath frequently incomplete or obscure; odor more tea-like than preceding; taste and numbing effect similar; powder pale green; grown more northward, thriving well at lower elevations and preferred by natives for chewing. Java and India coca (*E. Coca*, var. *Sprucea'num*, long-styled, styles exceeding stamens) seems identical with this variety but owing to inferiority is not exported.

CONSTITUENTS.—Cocaine (1860) .5–1 p. c., cinnamyl-cocaine, truxilline (truxil-cocaine, isatropyl-cocaine, cocamine), $C_{19}H_{23}NO_4$—all three upon hydrolysis yielding ecgonine and methyl alcohol; ecgonine, coca-tannic acid, wax, volatile oil, ash 8–10 p. c.; hygrine (volatile aromatic liquid) is doubted by some, while cocainidine, probably isomeric with cocaine, but weaker, has not yet been studied thoroughly.

Cocaina, Cocaine, $C_{17}H_{21}NO_4$.—This alkaloid, consisting of methyl alcohol, benzoic acid, and ecgonine, into which it separates by heating with strong sulphuric acid, is obtained by moistening leaves with sodium hydroxide solution, treating with benzin (kerosene), from which the alkaloids, as salts, can be transferred to diluted sulphuric acid by agitation; upon adding excess of sodium hydroxide solution the lesser alkaloids and cocaine are precipitated (hygrine, etc., remaining in solution); cocaine may now be separated by filtering and expressing, and purified by crystallizing from alcohol. It is in large, colorless, 4–6-sided monoclinic prisms, white crystalline powder, odorless, soluble in water (600), hot water (270), alcohol (6.5), chloroform (.7), ether (3.5), olive oil (12), very soluble in warm alcohol, slightly in liquid petrolatum, melts at 97° C. (207° F.); forms salts (hydrochloride, nitrate, sulphate, etc.). Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$–2 (.008–.13 Gm.).

PREPARATIONS.—1. *Cocainæ Hydrochloridum.* Cocaine Hydrochloride, $C_{17}H_{21}NO_4.HCl$. (Syn., Cocain. Hydrochl., Cocaine Chloride, Cocainæ Hydrochloras, Cocaine Hydrochlorate; Fr. Chlorhydrate de Cocaïne; Ger. Cocaïnum hydrochloridum, Kokainhydrochlorid.)

Manufacture: Dissolve pure alkaloid, cocaine, in alcoholic solution of hydrochloric acid, and allow anhydrous salt to crystallize. It is in colorless, transparent, monoclinic prisms, flaky, lustrous leaflets, white, crystalline powder, permanent, odorless, soluble in water (.4), alcohol (3.2), warm alcohol (2), chloroform (12.5), glycerin, insoluble in ether; aqueous solution (1 in 20) neutral, lævorotatory; melts at 183–191° C. (362–376° F.), the higher point indicating greater purity. *Tests:* 1. Aqueous solution (1 in 100) + silver nitrate T. S.—white precipitate, insoluble in nitric acid. 2. Aqueous solution (1 in 50) 5 Ml. (Cc.) + 5 drops of chromium trioxide solution (1 in 20)—yellow precipitate, redissolved on shaking; now add hydrochloric acid 1 Ml. (Cc.)—permanent orange crystalline precipitate. 3. Dissolve .1 Gm. in sulphuric acid 1 Ml. (Cc.)—not more than slight yellow tint (abs. of readily carbonizable substances)—add cautiously distilled water 2 Ml. (Cc.)—aromatic odor of methyl benzoate, on cooling—crystals of benzoic acid, dissolved on adding alcohol; incinerate .5 Gm.—ash non-weighable. *Impurities:* Cinnamyl-cocaine, isatropyl-cocaine, readily carbonizable substances. This salt is dispensed generally under the name of cocaine in (hypodermic) solutions, 2–4–5–10 p. c. Dose, gr. $\frac{1}{8}$–2 (.008–.13 Gm.).

Unoff. Preps.: I. LEAVES: *Fluidextract* (diluted alcohol), dose, ʒss–2 (2–8 Ml. (Cc.)). *Infusion,* 5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)). *Tincture,* 20 p. c. (diluted alcohol), dose, ʒj–4 (4–15 Ml. (Cc.)). *Wine,* 6.5 p. c., dose, ʒij–4 (8–15 Ml. (Cc.)). II. COCAINE: *Oleate,* 5–10 p. c. *Unguentum Cocainæ* (Br.), 4 p. c. III. COCAINE HYDROCHLORIDE: *Injectio Cocainæ Hypodermica* (Br.), 5 p. c., dose, ♏v–10 (.3–.6 Ml. (Cc.)). *Lamellæ Cocainæ, Discs* (Br.), $\frac{1}{50}$ gr. (.0013 Gm.).

PROPERTIES.—Cerebral stimulant, bitter tonic, diuretic, mydriatic, diaphoretic, anaphrodisiac, narcotic. Locally, has little action upon the unbroken skin, but acts upon mucous membranes and subcutaneous tissue as anæsthetic and analgesic, producing also its constitutional effects. It increases digestion, respiration, heart action, temperature, arterial tension, and the irritability of the sensory nerves, followed by mental, moral, and muscular depression. It anæsthetizes the gastric mucous membrane, thereby temporarily deadening the sensations of hunger and thirst, which, however, seem all the greater as the effects wear off; the brain is stimulated by increasing the blood supply, producing wakefulness, a sense of hilarity and well-being (similar to cannabis), increased muscular strength and endurance. Acts as a diuretic by checking waste processes, lessening the quantity of urea, but increases that of urine; dilates the pupil by stimulating the ends of sympathetic nerve in the iris. When full amount (leaves) chewed one works cheerfully as long as the effect lasts, irrespective of meal hour, which may continue 3–4 days from repeated doses—usually, however, food is taken at night, and only the meal of mid-day bridged over. Natives drink its tea like Chinese tea elsewhere, and carry a bag of leaves and one of ashes or lime; after forming a quid of the leaves deprived of ribs (ʒj; 4 Gm.), a little ash or lime is added to give pungency and to aid the secretion of saliva; each chew lasts an hour, when a new one follows. Cocaine, in general action, resembles atropine; causes little injury to natives, but strangers soon become haggard-looking and idiotic.

Uses.—In melancholia, hysteria, epilepsy, spinal paralysis, insanity, diabetes, headache, typhoid state, opium-habit, uterine inertia, vomiting of pregnancy, gastric irritability, cholera morbus, spermatorrhœa, debility, poisoning by hydrated chloral, opium, or bromides. Locally, to burns, painful ulcers, fissures of anus, hay fever, sore throat, laryngitis, hemorrhoids, bronchitis, coryza, and in surgical operations. No more than gr. $\frac{3}{4}$ (.045 Gm.) should be applied at once.

Poisoning: Have nervous excitement, oppression, and fulness of head, sometimes nausea and vomiting, pulse and respiration at first rapid, then slow, breathing labored, face cyanotic, pupils dilated, extremities cold, convulsions, coma, death; may have delirium and unconsciousness early, or only asphyxia. Place in horizontal position and fresh air, empty stomach, stimulants—strong coffee, etc., and if circulation fails—strychnine, ether, alcohol, amyl nitrite, caffeine, atropine, oxygen and ammonia inhalations; hydrated chloral (gr. 30–60; 2–4 Gm.), paraldehyde, sulphonal, chloroform, ether or morphine injections; artificial respiration; nitroglycerin (hypodermically) for convulsions. Chronic poisoning (*cocainism* or *habit*), marked by loss of flesh, disordered circulation, insane delusions and hallucinations, collapse, is more rapid and nearly as degenerative and serious as that of opium, and may be treated similarly, but usage does not create nerve irritation to the same extent, consequently one with a strong will power may desist abruptly its use without suffering other than the denial of mental satisfaction and pleasures, the craving for which it tends to establish.

Incompatibles: Alkalies, alkaline carbonates and bicarbonates, mercuric chloride, iodine, iodides, ammonia, zinc chloride, borax.

Synergists: Cerebral effects—alcohol, cannabis, belladonna; analgesic—atropine, phenol, conium, opium; mydriatic—atropine.

38. ZYGOPHYLLACEÆ. Guaiacum or Bean-caper Family.

Zi-go-fi-la′se-e. L. *Zygophyll-um* + aceæ, fr. Gr. ζυγόν, yoke, + φύλλον, leaf—*i. e.*, leaves foliolate, yoked and in pairs. Herbs, trees, shrubs. Distinguished by flowers, white, red, yellow, with fleshy disk; sepals 5, free, glandless; petals 4–5, filaments 8–10, having small scales; ovary lobed, 4–12-celled, superior, 2 filiform ovules in each, little or no albumin; beyond tropics; stimulants, alterative, diaphoretic, anthelmintic; wood hard, durable.

Genus: **1. Guaiacum (Guajacum).**

GUAIACUM. GUAIAC.

Guaiacum { **officinale,** *Linné,* / **sanctum,** *Linné.* } The resin of the wood.

Habitat. 1. West Indies, South America (Jamaica, Haiti, Cuba, Colombia, Venezuela). 2. West Indies (Cuba, Bahamas, Florida).

Syn. Guaïac Resin, Lignum Vitæ, Sanctum or Benedictum, Rockwood, Pockwood; Br. Guaiaci Resina; Fr. Gaïac, Gayac, Bois de Gaïac; Ger. Lignum Guajaci, Guajakholz, Franzosenholz, Pockholz; Fr. Résine de Gayac; Ger. Resina Guajaci, Guajakharz, Guajak.

Guai′a-cum. L. fr. Sp. *guayaco, guayacan*—*i. e.,* plant's native Haitian name.
Of-fi-ci-na′le. L. see etymology of (*Rheum*) *officinale,* page 172.
Sanc′tum. L. *sanctus, sancere,* consecrate—*i. e.,* used as incense in worship.
Guai′ac. The correct S. American name of the tree.

Plants.—*Guaiacum* (*Guajacum*) *officinale,* a tree 6–12 M. (20–40°) high, trunk .3–.5 M. (1–1½°) thick, branches knotty, stem-bark ash-gray, striated, variegated with greenish or purplish spots; leaves 7.5 Cm. (3′) long, evergreen, paripinnate, 2–4 pairs; leaflets obovate, 2.5–4 Cm. (1–1⅗′) long; flowers large, blue, 4–10, in axils of upper leaves; sepals 5; petals 5; stamens 10, about 18 Mm. (¾′) long; fruit capsule, 2-celled, each 1-seeded (black), obcordate; *Guaiacum* (*Guajacum*) *sanctum,* a tree 6–9 M. (20–30°) high; leaflets narrower,

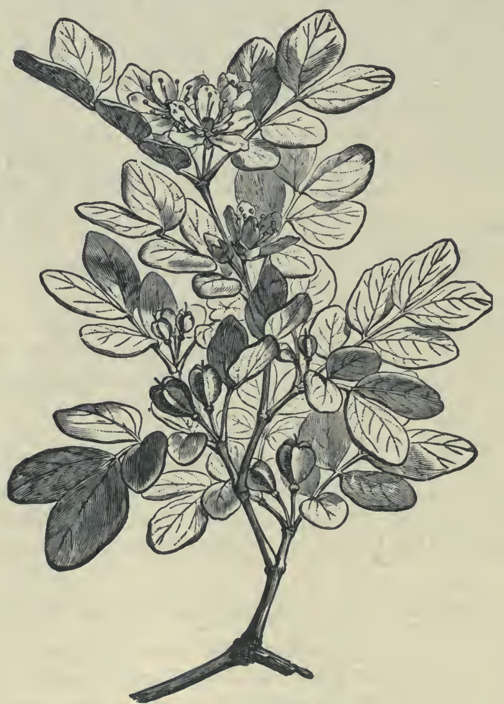


Fig. 214.—*Guaiacum sanctum.*

mucronate; fruit 5-celled, seeds red; wood of both species consists of sap and heart, the latter heavier than water, sp. gr. 1.30, very hard, brown or greenish-brown, resinous, sap yellowish, with heat emitting balsamic odor, taste slightly acrid; in shops as raspings. RESIN (guaiac), in irregular or large, nearly homogeneous masses, occasionally rounded or ovoid tears enclosing fragments of vegetable tissues, brownish-black, greenish-gray-brown on exposure, fracture with glossy lustre, thin pieces translucent, reddish, yellowish-brown; odor balsamic; taste slightly acrid; melts at 88° C. (190° F.); soluble in alcohol, ether, chloroform, creosote, solutions of alkalies, hydrated chloral T. S.; sparingly soluble in carbon disulphide, benzene, 85 p. c. soluble in alcohol, which, with excess of chlorine water or tincture ferric chloride —blue, changing quickly to green. POWDER, grayish, becoming green on exposure. *Tests:* 1. Macerate for 3 hours in 4–5 times its weight of purified petroleum benzin —filtrate colorless, no green color with equal volume of cupric acetate T. S. (abs. of rosin). *Solvents:* alcohol; acetone; chloroform; ether; alkalies. Dose, gr. 5–30 (.3–2 Gm.).

ADULTERATIONS.—Owing to careless collecting may contain admixtures 10, 15, 30 p. c.; thus *rosin*—heat for odor, or oil of turpentine will dissolve its own resin, leaving guaiac untouched; *damar*—80–90 p. c. soluble in benzin; *Peru guaiac resin*—42 p. c. soluble in benzin; *Carana resin* —alcoholic solution not precipitated by lead acetate; also *bark*.

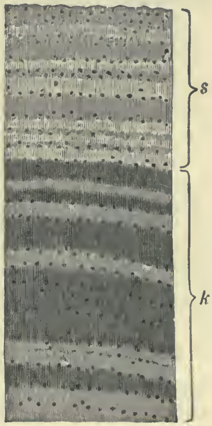


FIG. 215.—Guaiacum wood; cross-section, magnified 4 times; *k*, heartwood; *s*, sapwood.

Commercial.—The best *lignum vitæ* (wood of life—*i. e.*, its virtues thought to prolong life) comes from St. Domingo in logs several feet long, with adhering gray bark, showing on edges shining crystals of calcium sulphate; the bark and yellow sapwood are removed and the dark, hard heartwood is turned and shaped into various implements, etc., the wastings being reserved for medicine. The finest resin is also from Jamaica and Haiti ports, of which the wood contains 20–25 p. c., being obtained: 1, as a natural exudation; 2, by incisions made into the bark; 3, by scarifying logs in the middle, suspending them horizontally by two uprights, applying fire at both ends, and catching melted resin as it runs from the centre in calabash cups; 4, by boring a longitudinal auger hole in one end centrally, elevating and heating the other end, catching the exuding resin.

CONSTITUENTS.—Guaiaretic acid, $C_{20}H_{26}O_4$, 10 p. c., Guaiaconic acid (alpha-resin), $C_{19}H_{20}O_5$, 50–70 p. c., Guaiac beta-resin 10 p. c., gum 4–9 p. c., guaiacic acid, guaiac-yellow. Last two are crystalline, and may be dissolved out by milk of lime; if residue is now treated with hot alcohol, evaporated, and this residue in turn dissolved in hot solution of sodium hydroxide, the sodium salt of guaiaretic acid crystallizes out, while the mother-liquor contains guaiaconic acid and guaiac beta-resin, which, after removing alkali, are separated by ether, the latter being insoluble. Guaiaretic acid has a faint vanilla odor, is crystalline, not blue with nitric acid; guaiaconic acid is amorphous, colored blue by nitric acid and other oxidizing agents, guaiac-yellow occurs in pale yellow quadratic octahedra, having a bitter taste. By dry distillation of guaiac get *guaiacene*, C_5H_8O (odor of bitter almond), *guaiacol*, $C_7H_8O_2$ (a colorless aromatic oil, green, with ferric chloride), *creosol*, $C_8H_{10}O_2$ (resembles guaiacol), *pyroguaiacin*, $C_{18}H_{18}O_3$ (in inodorous scales, green by ferric chloride, blue with warm sulphuric acid), ash 4 p. c.

PREPARATIONS.—1. *Tinctura Guaiaci.* Tincture of Guaiac. (Syn., Tr. Guaiac.; Fr. Teinture de Résine de Gaïac; Ger. Tinctura Guajaci, Guajaktinktur.)

Manufacture: 20 p. c. Similar to Tinctura Aloes, page 110; menstruum: alcohol. Dose, ♏v–60 (.3–4 Ml. (Cc.)).

2. *Tinctura Guaiaci Ammoniata.* Ammoniated Tincture of Guaiac. (Syn., Tr. Guaiac. Ammon., Tinctura Guaiaci Composita; Fr. Teinture de Gaïac ammoniacale; Ger. Ammoniakalische Guajaktinktur.)

Manufacture: 20 p. c. Similar to Tinctura Aloes, page 110; menstruum: aromatic spirit of ammonia. Dose, ♏v–30 (.3–2 Ml. (Cc.)).

Unoff. Preps.: Compound Tincture, 12.5 p. c. (dil. alc.), +. *Glycerite,* 8.5 p. c. *Mixture,* 12.5 p. c. (tincture), + clarified honey 25, cinnamon water q. s. 100. *Compound Gargle,* 10 p. c. (am. tinct.). *Mistura Guaiaci* (Br.), 2.5 p. c., dose, ʒiv–8 (15–30 Ml. (Cc.)). *Trochiscus Guaiaci Resinæ* (Br.), 3 gr. (.2 Gm.). *Syrup.*

PROPERTIES.—Alterative, diaphoretic, expectorant, stimulant, antiseptic, astringent. Stimulates the flow of saliva, bronchial mucus, bile, and gastric juice, causing sometimes vomiting and purging; increases heart force and rapidity, dilates cutaneous bloodvessels, and large doses contract uterus. It is eliminated by bowels, bronchi, but chiefly kidneys.

USES.—The wood, owing to its variability, now is used seldom in medicine; was employed first in Europe 1508, the Spaniards prizing it highly at that period and since, for syphilis, rheumatism, gout, scrofula, and skin eruptions. Its great service is in furnishing resin, and (owing to its hardness, toughness, density, and durability) for making pestles, blocks, pulleys, rulers, skittle and bowling balls, hawser bearings, etc.

The resin, although very strong, is becoming less used, being replaced by the more powerful chemical alteratives such as potassium and sodium iodides, etc. Useful in rheumatism, gout, lumbago, syphilis, scrofula, skin eruptions, amenorrhœa, dysmenorrhœa, diphtheria, tonsillitis (quinsy). Guaiacol is substituted often for creosote in phthisis, coughs, etc. Dose, ♏ij–10 (.13–.6 Ml. (Cc.)).

Incompatibles: Spirit of nitrous ether, mineral acids, water.

Synergists: Sarsaparilla, stillingia, mezereum, sassafras, other diaphoretics, and some diuretics.

Allied Plant:

1. *Guaiacum angustifo'lium.*—S. Texas, Mexico. Wood hard, heavy, splitting irregularly, yellowish-brown. Sometimes substituted for that which formerly was official.

39. RUTACEÆ. Rue Family.

Ru-ta'se-e. L. *Rut-a* + aceæ, fem. pl. of *rutaceus,* of or resembling rue, fr. Gr. ῥυτή, ῥύω, to flow—*i. e.,* referring to medicinal properties (female). Trees, herbs, shrubs. Distinguished by leaves exstipulate, dotted with pellucid glands, containing aromatic volatile oil; sepals, 4–5; petals 4–5, imbricated; ovary connate or united by base, style, or stigma, superior; stamens distinct, equal or double the petals; albuminous or exalbuminous; tropics; antispasmodic, tonic, febrifuge, diuretic.

Genera: **1. Xanthoxylum. 2. Pilocarpus. 3. Barosma. 4. Citrus.**

XANTHOXYLUM. XANTHOXYLUM.

Xanthoxylum { **americanum,** *Miller,* / **Clava-Herculis,** *Linné.* } The dried bark.

Habitat. North America: 1. Canada to Virginia, N. Carolina; rocky woods, river banks. 2. Virginia to Florida, westward to Texas; sandy coast, dry soil.

Syn. Xanthox., Prickly Ash Bark: 1. Northern Prickly Ash Bark, Angelica Tree, Pepper (Yellow) Wood, Pellitory (Toothache) Bark or Tree. 2. Southern Prickly Ash Bark, West Indian (Yellow) Prickly Ash, Sea Ash, Pepper Wood, Hercules' Club, Yellow Hercules, Prickly Yellow Wood; Fr. Chavalier, Frêne épineux; Ger. Zahnweh(holz)rinde.

Xan-thox'y-lum (zan-thox'y-lum, erroneous). L. fr. Gr. ξανθός, yellow, + ξύλον wood—*i. e.,* roots are yellow.

A-mer-i-ca'num. L. belonging to America, American.

Cla'va-Her'cu-lis. L. *clava,* club, + *Hercules*—*i. e.,* resemblance of cone-like warts.

Plants.—*Xanthoxylum americanum,* shrub 2–4 M. (6–12°) high, covered with sharp, scattered prickles: leaves imparipinnate, leaflets 4–5 pairs, ovate, downy; flowers April–May, before the leaves, yellowish green, sessile, umbels, polygamous, sepaloid (corolla absent); fruit capsule, oval, punctate, greenish-red, 2-valved, 1 black seed; *Xanthoxylum Clava-Herculis,* small tree 6–12 M. (20–40°) high, .3–.6 M. (1–2°) thick, bark with prickles protruding through large corky cones, larger prickles on branches and petioles; leaflets 3–8 pairs, crenate, unequal-sided, shining; flowers June, after leaves appear, cymes (corolla present). Bark (*X. americanum*): *Northern,* in transversely curved fragments, quills, 2–15 Cm. ($\frac{4}{5}$–6′) long; bark .5–2 Mm. ($\frac{1}{50}$–$\frac{1}{12}$′) thick, brownish-gray with grayish patches of foliaceous lichens bearing numerous small black apothecia; longitudinally wrinkled, numerous whitish lenticels, and some brown, glossy, straight, 2–edged spines linear at base, 5 Mm. ($\frac{1}{5}$′) high, cork occasionally abraded, showing the yellowish, orange inner bark; inner surface yellowish-white, finely longitudinally striate, usually with numerous, bright, shining crystals; fracture short, uneven; odor slight; taste bitter, acrid, pungent; (*X. Clava-Herculis*): *Southern*, in transversely curved, irregular, oblong, flattened pieces, quills, 2–40 Cm. ($\frac{4}{5}$–16′) long; bark 1–4 Mm. ($\frac{1}{25}$–$\frac{1}{6}$′) thick, light gray, brownish-gray, marked by numerous large barnacle-shaped projections of cork, .5–3.5 Cm. ($\frac{1}{5}$–1$\frac{2}{5}$′) thick, often 2 Cm. ($\frac{4}{5}$′) high, otherwise with numerous grayish patches of foliaceous lichens, bearing blackish apothecia, and many elliptical lenticels; inner surface light yellowish-brown, olive-brown, obscurely longitudinally striate and free from crystals; odor and taste as in preceding. POWDER, light grayish-brown; microscopically—mostly irregular fragmental cork cells, lignified fragments of parenchyma containing either small starch grains, oily globules, or monoclinic prisms of calcium oxalate; stone cells often with reddish-brown substance; few non-lignified bast-fibres; the Northern usually without stone cells, while the calcium oxalate crystals and fragments of cork are relatively few. *Solvents:* alcohol, boiling water. Dose, gr. 10–30 (.6–2 Gm.).

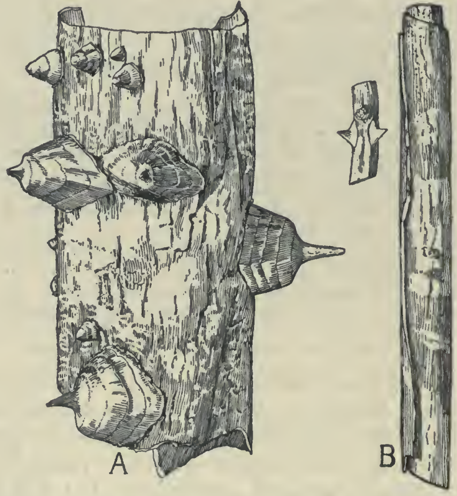


FIG. 216.—Xanthoxylum bark: *A*, Southern; *B*, Northern ($\frac{1}{3}$ Nat.).

ADULTERATIONS.—Rare: Chiefly bark of *Ara'lia spino'sa, Hercules' Club*, by accident or ignorance—easily recognized by serpentine transverse ridges bearing numerous slender, upward-curved, sharp, predacious spines, thinness, brownish color, less bitter and biting properties.

CONSTITUENTS.—Similar in both barks but not identical: Resins (2), Bitter principle (xanthoxylin-e), volatile oil (acrid, green), tannin, sugar, ash 12 p. c.

Resins.—One crystalline, white, tasteless, bitter in alcoholic solution; the other soft, acrid, constituting the brownish powder, *xanthoxylin*, resinoid of the "Eclectics." Dose, gr. 1–2 (.06–.13 Gm.).

Bitter Principle (*xanthoxylin-e*).—Probably an alkaloid identical with berberine; with sulphuric acid brown and dark red.

PREPARATIONS.—1. *Fluidextractum Xanthoxyli.* Fluidextract of Xanthoxylum. (Syn., Fldext. Xanthox., Fluid Extract of Xanthoxylum, Fluidextract of Prickly Ash; Fr. Extrait fluide de Frêne épineux; Ger. Zahnwehrindenfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: 75 p. c. alcohol. Dose, ♏x–30 (.3–2 Ml. (Cc.)).

Unoff. Preps.: Decoction, 5 p. c., dose ℥ss–2 (15–60 Ml. (Cc.)). *Extract,* dose, gr. 3–10 (.2–.6 Gm.).

PROPERTIES.—Alterative, stimulant, sialagogue, emmenagogue, diaphoretic, diuretic, causes salivation, tingling in tongue, increases cardiac action and arterial tension, also secretion from stomach, intestines, liver, and pancreas; resembles mezereum, guaiac, sanguinaria, and stillingia in action.

USES.—Chronic rheumatism, myalgia, lumbago, dropsies, atonic dyspepsia, syphilis, pharyngitis, as a masticatory for toothache, tongue paralysis. Externally as a counter-irritant in female pelvic diseases.

Allied Plants:

1. *Xanthoxylum florid'anum, Satin Wood.*—Identical with *X, carib'æum; X. ptero'ta,* Florida, Texas, Brazil; wood yellow, hard; bark and leaves pungent.

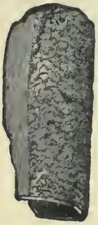


FIG. 217.—Angustura bark: one-half natural size.

2. *Cuspariæ Cortex, Cusparia Bark, Angustura.*—The bark of *Cuspa'ria Angostu'ra* (*Galipe'a Cusparia*); official 1820–1880; Northern South America. Tree 4.5–6 M. (15–20°) high, leaves with 3 leaflets, 15–25 Cm. (6–10′) long, 5–10 Cm. (2–4′) broad, spotted white, tobacco odor, flowers white; bark in flat, curved, or quilled pieces 2.5 Mm. ($\frac{1}{10}'$) thick, ochrey-gray, friable periderm, inside cinnamon-red, striæ of calcium oxalate, aromatic bitter; contains volatile oil, resin, angusturin, 4 alkaloids. Used for diarrhœa, dysentery, dyspepsia, typhoid, stimulant, febrifuge, large doses emetic; in infusion, tincture, extract. Dose, gr. 10–30 (.6–2 Gm.).

False Angustura Bark (*Strychnos Nux-vomica*) has stone-cells, no striæ of calcium oxalate; is very bitter, not aromatic, contains strychnine, brucine.

PILOCARPUS. PILOCARPUS.

Pilocarpus { **Jaborandi,** *Holmes,*
microphyllus, *Stapf.* } The dried leaflets, with not more than 5 p. c. of stalks bearing leaflets and stems, other matter, containing .6 p. c. of alkaloids.

Habitat. 1. Brazil—from Pernambuco; 2. Brazil—from Maranham; Paraguay, Uruguay; in forest-cleanings on the hill-slopes.

Syn. Pilocarp., Jaborandi, Pilocarpi Foliata; 1. Pernambuco Jaborandi. 2. Maranham Jaborandi; Fr. Jaborandi; Ger. Folia Jaborandi, Jaborandiblätter.

Pi-lo-car'pus. L. *pilus*, hair, or fr. Gr. πῖλος a cap, + καρπός fruit—*i. e.*, fruit hat-shaped.

Jab-o-ran'di. L. fr. Port. *zha-bo-ran-de'*—*i. e.*, South American name.

Mi-cro-phyl'lus. L. fr. Gr. μικρός small, + φύλλον leaf—*i. e.*, having small leaves.

Plants.—Shrubs 1.2–1.5 M. (4–5°) high, branches erect; bark smooth, with gray and white dots, root 18 Mm. ($\frac{3}{4}$') thick; flowers small, pinkish-purple, pedicellate, racemes 45 Cm. (18') long; fruit, 5 carpels 4 Cm. (1$\frac{3}{5}$') long, compressed, curved ridges dotted with oil-glands, carpels 1-seeded, reniform, black; leaves imparipinnate, .3–.4 M. (1–1$\frac{1}{2}$°) long, 2–5 pairs. Leaflets (*P. Jaborandi*): *Pernambuco*, oval, oblong, elliptical, 4–10.5 Cm. (1$\frac{3}{5}$–4') long, 2–4 Cm. ($\frac{4}{5}$–1$\frac{3}{5}$') broad, short, stout petiolules, acute, emarginate (rounded), base rounded or acute, mostly unequal, entire, narrowly revolute, smooth, shiny, coriaceous, glandular-punctate, grayish-brownish-green above, midrib mostly depressed, yellowish-, greenish-brown beneath, slightly pubescent on the prominent midvein; peculiarly aromatic when crushed; taste bitterish, becoming pungent with sialagogue effect; (*P. microphyllus*): *Maranham*, rhomboidally oval, obovate, elliptical, 1.5–5 Cm. ($\frac{3}{5}$–2') long, 1–3 Cm. ($\frac{2}{5}$–1$\frac{1}{5}$') broad, lateral ones nearly sessile, terminal ones

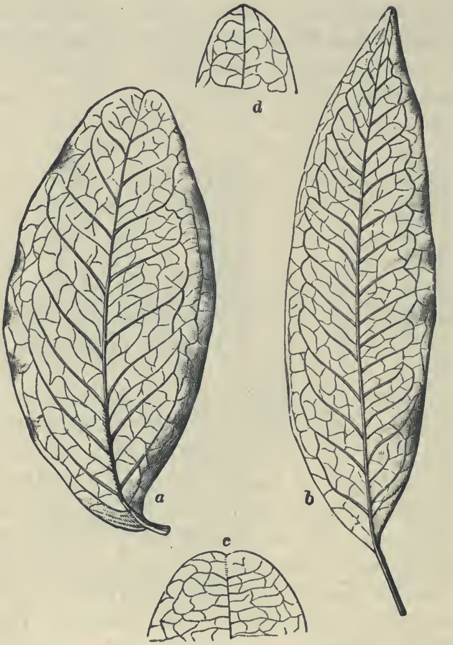


Fig. 218.—*Pilocarpus Jaborandi:* variously shaped leaflets. *a* and *c*, emarginate; *b* and *d*, pointed, blunt.

on margined petiolules, .5–1.5 Cm. ($\frac{1}{5}$–$\frac{3}{5}$′) long, nearly uniform grayish-, yellowish-green, rather thin, otherwise resembling the preceding. Powder, dark green-, greenish-brown; microscopically—epidermal cells 5–6-sided, stomata usually with 4 neighboring cells, fragments of fibro-vascular bundles showing tracheæ, wood-fibres, bast-fibres, rosette aggregates of calcium oxalate, oil-secretion reservoirs with oil globules, non-glandular hairs. *Solvents:* diluted alcohol; boiling water partially. Dose, gr. 15–30 (1–2 Gm.).

Adulterations.—Leaves from which pilocarpine has been extracted, or leaves of *Pilocarpus* species possessing little activity or of piperaceous plants (thin, subcoriaceous, ovate, not emarginate but acuminate, finely granular, not pellucid-punctate), or of *Monnie'ra trifo'lia* and *Casca'ria* species, or leaflets of *Swart'zia decip'iens* (ovoid, short hairy petiole, upper surface shining, lower minutely hairy, not pellucid-punctate, some only 5 Mm. ($\frac{1}{5}$′) long) for "Maranham Jaborandi," sometimes 30 p. c., or "False Jaborandi"—leaves of *Hæmatoxylon campechianum*, notched apex, pellucid-punctate, without alkaloid, with red-brown secreting vessels, cinnamon and clove odor.

Commercial.—Plant was introduced into Europe, 1847, and now is cultivated. The names *Jaborandi, Jamborandi, Iaborandi* are applied natively, in both generic and specific sense, to several dissimilar pungent plants having sialagogic, diaphoretic and sudorific properties, as *Serro'nea Jaborandi, Piper Jaborandi* (possibly the true Jaborandi), *P. unguicula'tum, P. citrifo'lium, P. reticula'tum, P. Mollico'mum, Erte'la* (*Auble'tia*) *trifo'lia, Xanthoxylum el'egans.* Leaves should be collected when grown, after rainy season, and, inclining to mustiness, should be dried thoroughly before packing. The official species are high-priced, scarce, and subject to much substitution, while the Rio Jaborandi (*P. Selloanus*), once official and popular, continues to have a limited demand in spite of great irregularity in characteristics and constituents.

Constituents.—Pilocarpine .5–1 p. c. (1874), isopilocarpine, pilocarpidine, jaborine (?), volatile oil .5 p. c., (resin, tannin, malic acid, salts), ash 7 p. c.

Pilocarpine (Pilocarpina), $C_{11}H_{16}N_2O_2$.—This liquid alkaloid, as first obtained under the name of jaborandine, was believed to be volatile, but this is not true, although it occurs as a colorless, syrupy liquid. It may be prepared by moistening powdered leaves with solution of sodium carbonate, exhausting with warm benzene, shaking out with diluted hydrochloric acid, after separation rendering acid solution alkaline with solution of sodium carbonate, shaking out with chloroform, evaporating chloroformic liquid getting residue of crude alkaloids; neutralize with diluted nitric acid, evaporate to dryness, purify by repeated crystallization from alcohol, dissolve pilocarpine nitrate in water, render alkaline with ammonia, shake out with chloroform, evaporate getting pure pilocarpine as a colorless syrupy liquid; it is soluble in water, alcohol, chloroform, slightly in ether, forms crystallizable salts (hydrochloride, nitrate, etc.); resembles nicotine in action.

Pilocarpinæ Hydrochloridum, Pilocarpine Hydrochloride, $C_{11}H_{16}N_2O_2.HCl$, *official.*—(Syn., Pilocarpin. Hydrochl., Pilocarpine Chloride, Pilocarpinæ Hydrochloras; Fr. Chlorhydrate de Pilocarpine; Ger. Pilocarpinum hydrochloricum, Pilokarpinhydrochlorid.) Obtained by neutralizing diluted hydrochloric acid (17.5) with pilocarpine (10), concentrating, setting aside over sulphuric acid to crystallize; it is in colorless, translucent crystals, odorless, faintly bitter taste, hygroscopic on exposure, soluble in water (.3), alcohol (3), hot alcohol (1.5), chloroform (366), insoluble in ether; aqueous solution (1 in 20) neutral or slightly acid, melts at 197° C. (387° F.). *Tests:* 1. Aqueous solution with silver nitrate T. S.—white precipitate, insoluble in nitric acid. 2. Incinerate .1 Gm.—ash non-weighable. *Impurities:* Foreign alkaloids, readily carbonizable substances. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.), administered best hypodermically (2 p. c. aqueous solution).

Pilocarpinæ Nitras, Pilocarpine Nitrate, $C_{11}H_{16}N_2O_2.HNO_3$, *official.*—(Syn., Pilocarpin. Nit.; Fr. Azotate de Pilocarpine; Ger. Pilocarpinum nitricum, Pilokarpinnitrat.) Obtained by neutralizing diluted nitric acid (121) with pilocarpine (40), evaporating to dryness, redissolving in alcohol, crystallizing; it is in shining crystals, odorless, permanent, soluble in water (4), alcohol (75), hot alcohol (21), insoluble in chloroform, ether, melts at 172° C. (342° F.). *Tests:* 1. Aqueous solution mixed with equal volume of ferrous sulphate T. S. and carefully poured over sulphuric acid without shaking—brown ring at juncture of two layers. *Impurities:* Chloride, etc. Should be kept dark, in well-closed containers. Dose, gr, $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.), administered best hypodermically (2 p. c. aqueous solution).

Isopilocarpine.—Obtained by action of heat or alkali on pilocarpine; it is a colorless, viscid oil, oxidizing into pilocarpic acid, $C_{11}H_{16}N_2O_5$, boiling at 261° C. (502° F.), distilling without decomposition, isomeric with pilocarpine; pilocarpidine, $C_{10}H_{14}N_2O_2$, found in *P. Jaborandi* but not in *P. microphyllus,* is a liquid body, differing from pilocarpine by auric chloride not precipitating aqueous solutions, in being weaker, deliquescent, oxidizing in air to syrupy jaboridine (possibly identical with jaborandine, $C_{10}H_{12}N_2O_3$; jaborine, $C_{22}H_{32}N_4O_4$, is of doubtful occurrence, although formerly believed to be in the leaves and to be formed by evaporating acid solutions of pilocarpine; as such it was yellow, amorphous, less soluble in water, but more so in ether than pilocarpine, isomeric with it (same molecular formula), but antagonizing its action, resembling atropine; the commercial jaborine has been found to be a brown oil composed of isopilocarpine, pilocarpidine, pilocarpine, and coloring matter.

Volatile Oil.—Obtained by distillation at 176° C. (350° F.), and is chiefly a terpene (pilocarpene) $C_{10}H_{16}$, with a little solid paraffin-like substance, sp. gr. 0.875.

PREPARATIONS.—1. *Fluidextractum Pilocarpi.* Fluidextract of Pilocarpus. (Syn., Fldext. Pilocarp., Fluid Extract of Pilocarpus, Fluidextract of Jaborandi; Fr. Extrait fluide de Jaborandi; Ger. Jaborandifluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: 67 p. c. alcohol; reserve first 80 Ml. (Cc.), in which dissolve soft extract, assay, and add enough menstruum for the 100 Ml. (Cc.) to contain .55–.65—.6 Gm. of the alkaloids. Dose, ♏xv–30 (1–2 Ml. (Cc.)).

Unoff. Preps.: Extract, dose, gr. 3–10 (.2–.6 Gm.). *Infusion,* dose, ℥j–2 (30–60 Ml. (Cc.)). *Tinctura Pilocarpi* (*Jaborandi*), 20 p. c., dose, ʒss–2 (2–8 Ml. (Cc.)). Pilocarpine nitrate (Br.), phosphate, acetate, hydrobromide, dose, each gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.), hypodermically.

Properties.—Diaphoretic, sialagogue, myotic, cardiac depressant, emetic, diuretic (repeated small doses), galactagogue, abortive. Full doses cause flushed face, quickened circulation and respiration, profuse sweating and salivation (lasting 2–4 hours, losing in perspiration 9–15 ounces (.27–.45 L.), in saliva 10–27 ounces (.3–.8 L.), these always being in the inverse ratio); increases bronchial, nasal, mammary, gastric, and intestinal secretions, lowers temperature 1–4 degrees, contracts pupils, produces chilliness and weakness. The heart soon becomes slowed and arterial pressure lowered, by stimulating the terminations of the vagus, or by depressing the motor centres in the heart-muscle. Both the fluid and solids (especially urea) of the perspiration are increased by direct influence on the nerve-endings governing its secretion, while the cells of the salivary glands are stimulated directly.

Uses.—Dropsies, pleurisy, uræmia, pulmonic œdema, catarrhal jaundice, mumps, rheumatism, coryza, cold, influenza, Bright's disease, meningitis, diabetes, agalactia, parotitis, asthma, hiccough, erysipelas, diphtheria; best antidote to atropine, hyoscyamine, daturine, agaricin, etc.; powerful stimulant to hair growth, locally and internally. In ophthalmia use pilocarpine, in amblyopia (from alcohol or tobacco), detached retina, chronic iritis, keratitis, glaucoma, atrophic choroiditis, instead of physostigmine as a myositic. To avoid nausea, may give in form of enema.

Poisoning: Have profuse sweating, dizziness, salivation, vomiting, purging, contracted pupils, pain in eyes. Empty the stomach and wash it out with tannin; give atropine hypodermically and morphine to control nausea and vomiting; cardiac stimulants if necessary.

Incompatibles: Atropine, morphine, tannin, caustic alkalies, ferric and metallic salts.

Synergists: Aconite, veratrum viride, gelsemium, sarsaparilla, spirit of nitrous ether, and drugs which paralyze the vasomotor system.

Allied Plants:

1. *Pilocarpus Selloa'nus* (possibly the same as *P. pinnatifo'lius,* leaflets formerly official under both names); 2. *P. grandiflo'rus;* 3. *P. pauciflo'rus;* 4. *P. heterophyl'lus;* 5. *P. spica'tus;* 6. *P. trachylo'phus.* All produce leaves of similar medicinal value.

BUCHU. BUCHU.

Barosma {**betulina,** (*Thunberg*) *Bartling et Wendland*,
serratifolia, (*Curtis*) *Willdenow*. } The dried leaves, with not more than 10 p. c. of stems, foreign matter.

Habitat. S. Africa, Cape Colony (Cape of Good Hope, Cape Town); mountains.

Syn. Bookoo, Buku, Bucku, Bucco; Br. Buchu Folia, Folia Bucco, Diosmæ or Barosmæ; Fr. Feuilles de Bucco (Booko, Buchu); Ger. Bucku or Buccoblätter.

Ba-ros'ma. L. fr. Gr. βαρύς heavy, + ὀσμή odor—*i. e.*, its powerful smell.

Be-tu-li'na. L. *betulinus*, fr. Celtic *betu*, their name for birch—*i. e.*, leaves resembling birch leaves.

Ser-ra-ti-fo'li-a. L. *serratus*, notched like a saw, + *folium*, a leaf—*i. e.*, leaves with margins saw-like, serrated.

Buchu (bu'ku). African plant name; *Diosma*, old name, meaning "divine odor."

Plants.—Woody shrubs, .3–1.2 M. (1–4°) high, branches many, stiff, angular, bark smooth, purple; young twigs covered with immersed oil-glands; flowers solitary, pink; calyx 5 segments, deeply cut; petals 5, glandular-punctate; stamens 5; fruit 5-coccus capsule, adherent by inner margins, 9 Mm. ($\frac{3}{8}'$) long, 12 Mm. ($\frac{1}{2}'$) broad, 5-seeded. Leaves (*B. betulina*): *Short*, rhomboidally oval, obovate, 9–25 Mm. ($\frac{3}{8}$–$1'$) long, 4–13 Mm. ($\frac{1}{6}$–$\frac{1}{2}'$) broad, apex obtuse, recurved, serrate, finely dentate, oil gland at the base of each tooth, cuneate base, yellowish-green, coriaceous, glandular-punctate, both surfaces papillose, under longitudinally striate, petiole 1 Mm. ($\frac{1}{25}'$) long, odor and taste characteristic, aromatic, mint-like; (*B. serratifolia*): *Long*, linear-lanceolate, 2.5–4 Cm. (1–$1\frac{3}{5}'$) long, 4–6 Mm. ($\frac{1}{6}$–$\frac{1}{4}'$) broad, apex rounded or truncate with an oil gland, serrate, glandular, otherwise resembling the preceding; stems of both 1 Mm. ($\frac{1}{25}'$) thick, yellowish-green, brownish, cylindrical, longitudinally furrowed, prominent leaf-scars nearly opposite to each other giving a jointed character. Powder, yellowish-green; microscopically—many sphæro-crystals from epidermis, and mucilage cells. *Solvents:* alcohol; boiling water partially. Dose, gr. 15–30 (1–2 Gm.).

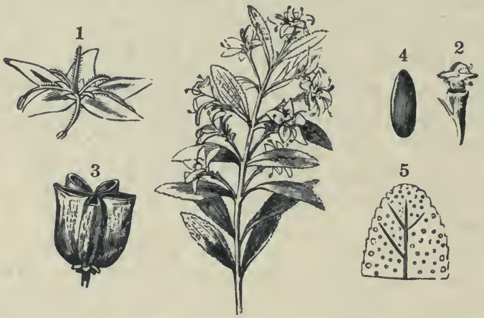


Fig. 219.—*Barosma crenulata:* *1*, calyx; *2*, style and stigma; *3*, fruit; *4*, seed; *5*, dots on leaf.

Adulterations.—Leaves, branchlets, flowers and non-aromatic capsules of allied species, also leaves of *Empleurum serrulatum*, which are yellowish-green, acute, different odor and taste, less mucilaginous and contain volatile oil 1 p. c., without any crystalline content.

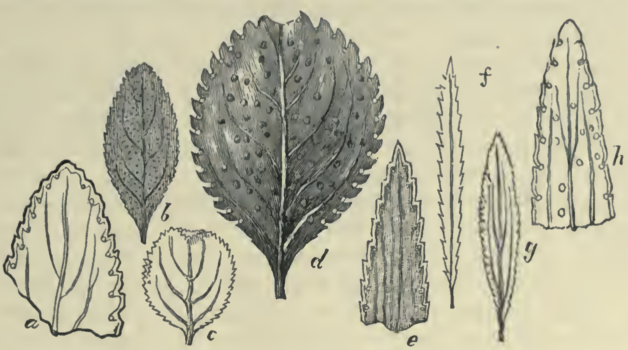


Fig. 220.—Buchu: *a*, *b*, *Barosma crenulata;* *c*, *d*, *B. betulina;* *g*, *h*, *B. serratifolia;* *e*, *f*, *Empleurum serrulatum;* *b*, *c*, *f*, *g*, *natural size.*

Commercial.—Grows in stony, hilly valleys; cultivated in gardens, since 1774, for persistent attractive flowers. There are two varieties: 1, *Short* (*B. betulina*), although often mixed with *B. crenulata*, whose leaves once were official, being somewhat similar but 18–30 Mm. ($\frac{3}{4}$–$1\frac{1}{5}'$) long, 6–8 Mm. ($\frac{1}{4}$–$\frac{1}{3}'$) broad, flowers white; 2, *Long* (*B. serratifolia*), weaker than preceding—volatile oil .66 p. c., which is without diosphenol. Imported chiefly in large bales.

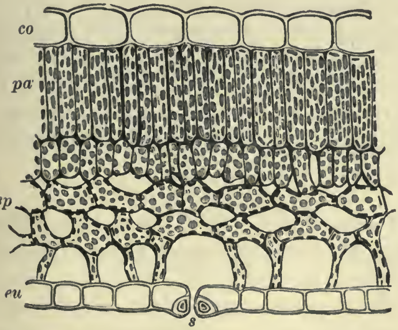


Fig. 221.—Buchu leaf: portion of a cross-section: *pa*, palisade cells; *sp*, spongy parenchyma; *co*, upper epidermis; *eu*, under epidermis; *s*, stomata.

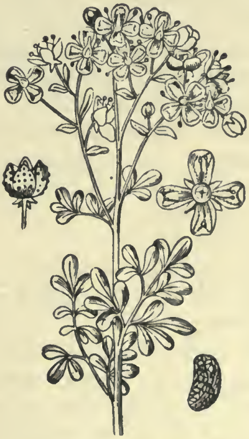


Fig. 222.—*Ruta graveolens.*

Constituents.—Volatile oil 1–1.6 p. c., bitter glucoside (barosmin), hesperidin, resin, gum, salts, ash 4–7 p. c.

Volatile Oil, $C_{10}H_{16}O$.—This gives the medicinal properties, and is obtained by distillation and rectifying over sodium; sp. gr. 0.969, contains some $C_{10}H_{18}O$ (a body having peppermint-like odor), and upon cooling separates 30 p. c. barosma camphor, or phenol *diosphenol*, $C_{10}H_{16}O_2$, a stearoptene occurring in white needle-like crystals, blackish-green with ferric salts.

Barosmin (*diosmin, rutin*).—Soluble in ether, volatile oils, dilute acids and alkalies, sparingly in alcohol, crystallizes in microscopic needles.

Preparations.—1. *Fluidextractum Buchu.* Fluidextract of Buchu. (Syn., Fldext. Buchu, Fluid Extract of Buchu; Fr. Extrait fluide de Bucco; Ger. Buccofluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: alcohol. Dose, ♏xv–30 (1–2 Ml. (Cc.)).

Unoff. Preps.: Compound Fluidextract, 62.5 p. c., + cubeb 12.5, juniper berries 12.5, uva ursi 12.5, alcohol 67 p. c. q. s. 100. *Elixir,* 12.5 p. c. *Compound Elixir,* 25 p. c. (fldext. co.). *Elixir with Potassium Acetate,* 8.5 p. c. *Infusum Buchu* (Br.), 5 p. c., dose, ℥ss–2 (15–60 Ml. (Cc.)). *Tinctura Buchu* (Br.), 20 p. c. (alcohol 60 p. c.), dose, ʒj–2 (4–8 Ml. (Cc.)).

Properties.—Diuretic, tonic, stimulant, carminative, diaphoretic; increases the fluids and solids of the urine, imparting peculiar odor; acts as a tonic, astringent, and disinfectant to the urinary tract, diminishing secretions. Large doses emetic, cathartic, causing burning in stomach, strangury; eliminated by the kidneys and bronchial mucous membrane.

Uses.—Gravel, lithemia, vesical catarrh, irritated urethra, gonorrhœa, gleet, chronic bronchitis, inflamed prostate, dropsy, retention or incontinence of urine, feeble digestion, flatulency; should not be given when inflammation is severe; often combined with alkalies, potassium hydroxide, etc. The native Hottentots, from whom the English and Dutch physicians learned its virtues, use an ointment as vulnerary, and a vinous tincture in gastric and vesical affections; they also value it as a perfume, rubbing the powdered leaves upon their greased bodies.

Allied Plants:

1. *Barosma crenula'ta,* official 1840–1900. *B. Ecklonia'na,* leaves oval, 2.5 Cm. (1′) long, rounded at base, crenate, growing from pubescent shoots.

2. *Empleu'rum serrula'tum.*—Leaves sometimes mixed with buchu, occasionally constituting the main bulk; may be distinguished by their acrid taste, peculiar odor—differing from buchu—longer, narrower than even *B. serratifolia,* sides parallel, apex acute and glandless, coarsely dentate (serrulate); when held up to the light lateral veins not as straight, shorter and less strongly developed; contain peculiar volatile oil .64 p. c., possessing characteristic odor. Properties considered to differ from those of buchu.

3. *Ru'ta grave'olens.*—The leaves, official 1830–1880; S. Europe, cultivated. Plant .6–1 M. (2–3°) high, woody; flowers yellow; fruit capsule, 4–5-lobed; seeds black, many, all parts active; leaflets 12–25

Mm. (½–1′) long, 6 Mm. (¼′) wide, crenate, thick, pellucid-punctate, aromatic, bitter; contain volatile oil (Oleum Rutæ, official 1870–1890, greenish-yellow, aromatic), rutin, (rutic or rutinic acid, $C_{42}H_{50}O_{25}$—bitter, yellow, crystalline glucoside, identical with barosmin, decomposing into quercetin, etc.). Used as stimulant, emmenagogue, and nervine, in hysteria, colic, amenorrhœa. Dose, gr. 5–20 (.3–1.3 Gm.); oil, ♏j–5 (.06–.3 Ml. (Cc.)).

4. *Pte'lea trifolia'ta, Wafer-ash, Hop-tree, Swamp-Dogwood, Wing-seed, Shrubby Trefoil.*—Root-bark; N. America—N. Y.–Fla.–Texas; rocky places. Handsome shrub, 2.4–3.6 M. (8–12°) high, branches dark brown; leaves petiolate, light green, trifoliate; leaflets sessile, ovate, short-acuminate, crenulate, lateral ones inequilateral, terminal one cuneate at base, finely pellucid-punctate; root-bark one or more inches long, light brown, wrinkled, with thin epidermis, internally yellowish-white, darker by exposure, odor peculiar, aromatic, taste bitter, pungent, acrid; contains berberine (bitter, tonic), tannin, gallic acid, resin. Aromatic, tonic, stimulant, antiperiodic; dyspepsia, low fevers with gastro-intestinal irritation, typhoid conditions. Dose, gr. 15–30 (1–2 Gm.), infusion, ℥ss–1 (15–30 Ml. (Cc.)); fluidextract. Leaves and young shoots anthelmintic; fruit (samara) aromatic, bitter, good substitute for hops.

AURANTII AMARI CORTEX. BITTER ORANGE PEEL.

Citrus Aurantium, var. **amara,** *Linné.* } The dried rind of the fruit.

Habitat. N. India, cultivated near the Mediterranean Sea, Spain, W. Indies, Madeira, China, S. and S. W. United States, Florida, California, etc.

Syn. Aurant. Amar. Cort., Curaçao (Wild) Orange, Aurantii Pericarpium, Cortex Pomorum Aurantii; Br. Aurantii Cortex Recens, Aurantii Cortex Siccatus; Fr. Écorce (Zeste) d'Orange amère, Écorce de Bigarade; Ger. Cortex Aurantii Fructus, Pomeranzenschale.

Cit'rus. L. fr. Gr. *κίτριον*, after the town of Citron in Judea, where it formerly flourished.

Au-ran'ti-um. L. *aurum*, gold—*i. e.*, yellow color of fruit.

A-ma'ra. L. *amarus*, bitter—*i. e.*, the decided bitter taste of the fruit.

Orange. Eng. fr. Skr. *nagarange* through the Arab. *naranj*.

Plant.—Small tree 3–4.6 M. (10–15°) high; stem branched; bark shining, smooth, greenish-brown; leaves 7.5–10 Cm. (3–4′) long, ovate, evergreen, faintly serrate, with oil-vesicles, fragrant, petioles 12–25 Mm. (½–1′) long; flowers May, 2.5 Cm. (1′) broad, white; fruit 5–10 Cm. (2–4′) in diameter, round, red or yellow, 9–11-celled, each several-seeded. Rind (zest), in narrow thin bands (ribbons), often elliptical, flattened, curved pieces (quarters), 3–6 Cm. (1⅕–2⅖′) long; outer surface convex, yellowish-brown (ribbons), greenish-brown (quarters), coarsely reticulate, edges recurved; inner surface concave, whitish, numerous conical projections and yellowish-white fibro-vascular bundles; fracture hard; transverse section light brown, spongy, outer layer with 1–2 rows of oil reservoirs; odor fragrant; taste aromatic, bitter. Powder, yellowish-white; microscopically—

many fragments of parenchyma cells, few of tracheæ and membrane, calcium oxalate crystals; with potassium hydroxide T. S.—yellowish. *Solvents:* alcohol; water. Dose, gr. 15–30 (1–2 Gm.).

Commercial.—This bitter fruit grows mostly in Spain, Madeira, India, China, being known as Seville or Bigarade Orange, and is not in the fresh state a commercial article with us. The Mandarin (*C. sinen'sis*), S. Europe, is much smaller, having flattened ends, very thin rind, and pleasant taste. The celebrated Bizarria, of Italy, produces on the same stem oranges, lemons, and citrons, and these often in mixed parts.

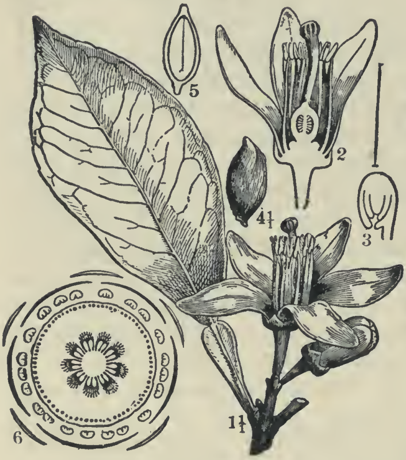


Fig. 223.—*Citrus aurantium,* var. *amara:* *1,* the end of a flowering twig; *2,* flower, vertical section; *3,* longitudinal section of ovary; *4,* seed; *5,* longitudinal section of seed; *6,* diagram of flower.

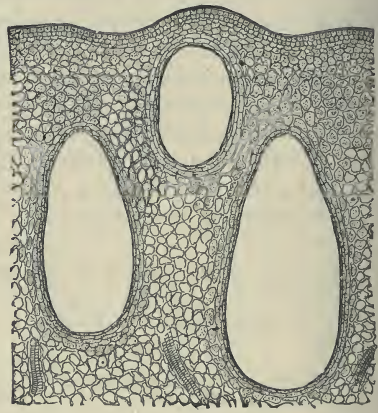


Fig. 224.—Orange peel: transverse section, magnified 65 diam.

Constituents.—Volatile oil, naringen (aurantiin) very bitter glucoside, aurantiamarin 1.5–2.5 p. c., leading bitter glucoside, isohesperidin .4–3 p. c., aurantiamaric acid .1 p. c., hesperidin, hesperic acid, (fixed oil, resin, gum, albumin, tannin, ash 4–7 p. c.).

Preparations.—I. Rind: 1. *Fluidextractum Aurantii Amari.* Fluidextract of Bitter Orange Peel. (Syn., Fldext. Aurant. Amar., Fluid Extract of Bitter Orange Peel; Fr. Extrait fluide d'Écorce d'Orange amère; Ger. Pomeranzenschalen fluidextrakt.)

Manufacture: Similar to Fluidextractum Aconiti, page 202; menstruum: 75 p. c. alcohol. Dose, ʒss–1 (2–4 Ml. (Cc.)).

2. *Tinctura Aurantii Amari.* Tincture of Bitter Orange Peel. (Syn., Tr. Aurant. Amar.; Br. Tinctura Aurantii; Fr. Teinture d'Écorce d'Oranges amères; Ger. Pomeranzen(schalen)tinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: 60 p. c. alcohol. Dose, ʒj–2 (4–8 Ml. (Cc.)).

3. *Tinctura Cinchonæ Composita,* 8 p. c. 4. *Tinctura Gentianæ Composita,* 4 p. c.

II. Flowers: 1. *Aqua Aurantii Florum Fortior.* Stronger Orange Flower Water. (Syn., Aq. Aurant. Flor. Fort., Aqua Aurantii Florum, Triple Orange Flower Water.)

Manufacture: Obtained as a by-product in distilling oil of orange flowers, or by collecting 3 parts of distillate from 2 of flowers. It is a saturated aqueous solution, colorless, clear, faintly opalescent, strong pleasant odor and taste of orange blossoms; must be free from empyreuma, mustiness, mucoid growths. *Tests:* 1. Evaporate 100 Ml. (Cc.)—residue .001 Gm.; neutral, slightly acid. 2. With hydrogen sulphide T. S. or sodium sulphide T. S.—no reaction (abs. of metallic impurities). Should be kept cool, dark, in bottles stoppered with a pledget of purified cotton. Dose, ʒj–4 (4–15 Ml. (Cc.)).

Preps.: 1. *Aqua Aurantii Florum.* Orange Flower Water. (Syn., Aq. Aurant. Flor., Aqua Florum Naphæ; Fr. Eau (Hydrolat.) distillée de Fleurs d'Oranger, Eau de Naphe; Ger. Orangenblüthenwasser.)

Manufacture: Mix, just before using, equal volumes of stronger orange flower water and recently boiled distilled water. Dose, ʒij–8 (8–30 Ml. (Cc.)).

Preps.: 1. *Syrupus Aurantii Florum.* Syrup of Orange Flowers. (Syn., Syr. Aurant. Flor.; Fr. Sirop de Fleurs d'Oranges; Ger. Pomeranzenblüthensirup.)

Manufacture: Dissolve by agitation sugar 85 Gm. in orange flower water 45 Ml. (Cc.), add of the latter q. s. 100 Ml. (Cc.), mix thoroughly, strain. Dose, *ad libitum;* as a flavoring vehicle.

2. *Syrupus Lactucarii*, 5 p. c.

2. *Trochisci Acidi Tannici*, q. s.

Unoff. Preps.: Infusum Aurantii (Br.), 5 p. c., dose, ʒiv–8 (15–30 Ml. (Cc.)). *Infusum Aurantii Compositum* (Br.), 2.5 p. c. (+ lemon peel 1, clove .5). *Vinum Aurantii* (Br.). *Oil of Fresh Peel. Oil of Flowers* (Nerolé).

Properties.—Stimulant, tonic, carminative, stomachic, bitter; excessive doses of both peel and oil cause colic, convulsions, occasionally death.

Uses.—In indigestion, flatulence, corrigent to purgatives; aromatic when in combination with gentian, calumba, quassia, cinchona, etc.; most of the preparations are used as flavoring agents. Workmen employed among the fruit have skin eruptions, nervousness, headache, gastralgia, insomnia, muscular spasms.

AURANTII DULCIS CORTEX. SWEET ORANGE PEEL.

Citrus Aurantium, var. **sinensis**, *Gallesio*.	The outer rind of the fresh, ripe fruit.

Habitat. Same as *C. Aurantium*, var. *amara*.

Syn. Aurant. Dulc. Cort., Curaçao, Navel (Seedless) Orange, Forbidden Fruit, Golden (Orange) Apple, Nerotia Flowers; Fr. Écorce (Zeste) d'Orange douce; Ger. Apfelsinenchalen.

Si-nen'sis. L. (Chinensis) Chinese, of or belonging to China—*i. e.*, its chief habitat.

PLANT.—Small tree, 4.5–6 M. (15–20°) high, identical with *C. Aurantium*, var. *amara*, differing only in point of variety, but having leaves and flowers more fragrant, and the fruit sweeter, larger, deeper yellow. RIND (zest), the outer orange-yellow layer recently separated by grating or paring, consisting of epidermal cells, parenchyma cells of sarcocarp with chromoplastids, oil reservoirs and globules of volatile oil; odor highly fragrant; taste pungently aromatic. *Solvents:* alcohol; water. Dose, gr. 15–30 (1–2 Gm.).

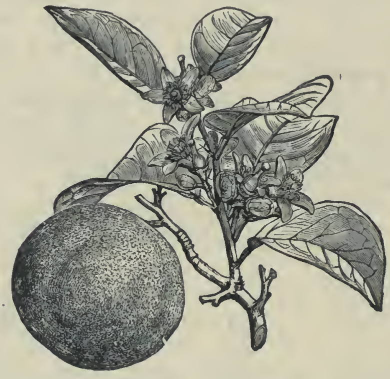


FIG. 225.—*Citrus Aurantium*, var. *sinensis*.

Commercial.—This sweet fruit grows only by cultivation; was unknown to the Greeks and Romans, being introduced first into Europe by the Portuguese in the 15th century. There are now some fifty varieties cultivated in Spain, Portugal, Madeira, Azores, China, West Indies, S. and S. W. United States, many of which have been given commercial names after the districts of production, as China, Portugal, Havana, Florida, California, Messina, and Malta (blood-red). These are imported in boxes of 100–200, having each orange wrapped in tissue-paper, the sweetest coming to us from Havana, Florida, and California.

CONSTITUENTS.—Volatile oil, hesperidin, (fixed oil, resin, gum, tannin, ash 4–5 p. c.).

Oleum Aurantii. Oil of Orange, *official.*—(Syn., Ol. Aurant., Oleum Aurantii Corticis, U. S. P. 1900, Orange Oil, Oil of Sweet Orange, Oleum Aurantiorum, Essence (Essential Oil) of Orange; Fr. Huile d'Orange; Ger. Pomeranzenschalenöl.) This volatile oil is produced mostly in S. Italy, Sicily, by expression from the fresh peel of sweet orange (and its varieties), or rupturing the oil-glands mechanically and collecting the liberated oil, as with oil of lemon; if obtained by distillation the product is decidedly less fragrant. It is a yellow liquid, characteristic odor and taste of orange peel, sp. gr. 0.844, soluble in 4 vols. of alcohol; contains limonene (citrene, hesperidene), $C_{10}H_{16}$, 90 p. c., odor bearers (citral, citronellal, methyl ester of anthranylic acid). *Tests:* 1. Dextrorotatory; portion distilling below 170° C. (338° F.) should not yield pinene nitrosochloride and nitrosopinene, nor have a terebinthinate odor or taste (abs. of oil of turpentine. Formerly the oil from the peel of bitter orange was also official, which chemically is indistinguishable, but in spite of superior flavor is now very scarce and usually mixed with oil of sweet orange. Oil having a terebinthinate odor must not be dispensed. Should be kept cool, dark, in small, well-stoppered, amber-colored bottles (to avoid developing terebinthinate odor). Usually shipped in tinned-copper cans. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

Adulterations.—Oil of turpentine, alcohol, etc.

Preparations.—I. Rind: 1. *Tinctura Aurantii Dulcis.* Tincture of Sweet Orange Peel. (Syn., Tr. Aurant. Dulc.; Fr. Teinture d'Orange douce; Ger. Apfelsinenschalentinktur.)

Manufacture: 50 p. c. Similar to Tinctura Aloes, page 110—macerating in alcohol 100 Ml. (Cc.), filtering through purified cotton, and finishing with alcohol q. s. 100 Ml. (Cc.). Dose, ʒj–2 (4–8 Ml. (Cc.)); as a flavoring vehicle.

Preps: 1. *Syrupus Aurantii.* Syrup of Orange. (Syn., Syr. Aurant., Syrupus Aurantii Corticis, Syrup of Orange Peel; Fr. Sirop d'Écorce d'Orange; Ger. Pomeranzen(Orangen)-schalensirup.)

Manufacture: Triturate purified talc 1.5 Gm. with tincture of sweet orange peel 5 Ml. (Cc.), add gradually distilled water 40 Ml. (Cc.), filter, add through filter distilled water q. s. 45 Ml. (Cc.); dissolve in this, by agitation, citric acid .5 Gm., sugar 82 Gm. (without heat), add distilled water q. s. 100 Ml. (Cc.), mix thoroughly. Dose, *ad libitum;* as a flavoring vehicle.

II. Oil: 1. *Spiritus Aurantii Compositus.* Compound Spirit of Orange. (Syn., Sp. Aur. Co.; Fr. Esprit d'Orange composée; Ger. Zusammengesetzter Orangengeist.)

Manufacture: 20 p. c. Dissolve oil 20 Ml. (Cc.), + oil of lemon 5 Ml. (Cc.), oil of coriander 2 Ml. (Cc.), oil of anise .5 Ml. (Cc.) in alcohol q. s. 100 Ml. (Cc.). Should be kept cool, dark, in completely filled, well-stoppered bottles. As a flavoring vehicle.

Preps: 1. *Elixir Aromaticum.* Aromatic Elixir. (Syn., Elix. Arom., Simple Elixir; Fr. Elixir aromatique; Ger. Aromatisches Elixir.)

Manufacture: 1⅕ p. c. To compound spirit of orange 1.2 Ml. (Cc.), add alcohol q. s. 25 Ml. (Cc.), to this add syrup 37.5 Ml. (Cc.), in several portions with agitation, distilled water 37.5 Ml. (Cc.), purified talc 3 Gm., filter until clear, wash filter with 25 p. c. of alcohol q. s. 100 Ml. (Cc.); as a flavoring vehicle.

Prep.: 1. *Elixir Glycyrrhizæ,* 87.5 p. c.

Properties and Uses.—Aromatic; chiefly for flavoring and in perfumery; fruit deliciously edible.

LIMONIS CORTEX. LEMON PEEL.

Citrus medica, var. **Limonum,** } The outer rind of the fresh ripe fruit.
(Risso) Hooker filius.

Habitat. N. India; cultivated in subtropics, Mediterranean Basin, United States (California, Florida), Australia, etc.

Syn. Limon. Cort.; Fr. Écorce (Zest) de Citron (Limon); Citron, Limon; Ger. Cortex Fructus, Citri, Flavido Corticis Citri, Citronen Limonen)–schale; Limone, Citrone.

Med'i-ca. L. *medicus,* medical, curative—*i. e.,* properties useful in medicine.

Li-mon'um. L. a lemon, fr. Arab. *limun, limu,* taken from Skr. *nimbuka.*

Plant.—Straggling bush or tree, 3–4.5 M. (10–15°) high, more tender than the orange, having many angular branches and sharp spines in the leaf-axils; bark gray, that of branches green, of twigs reddish or purple; leaves evergreen, 5–6 Cm. (2–2⅖′) long, ovate, acute, serrate, 12 Mm. (½′) petioles; flowers all the year round, sweet-scented, white to purplish-pink; fruit ovoid berry 7.5 Cm. (3′) long with nipple-shaped extremity, smooth, depressed punctations over the oil-glands, structure like orange; pulp acid, yellow; seeds as in orange, only smaller. Peel, the outer, lemon-yellow, dark yellow layer, recently separated by grating, paring, and consisting of an epidermal layer, numerous parenchyma cells containing yellow chromoplastids, and large oil reservoirs with globules of the volatile oil; odor highly fragrant, distinctive; taste pungent, aromatic; microscopically—sections mounted in a fixed oil show epidermal layer (small tabular cells), hypodermal layer containing numerous plastids, a mesocarp with colorless, thin-walled parenchyma, large elliptical oil reservoirs, granular

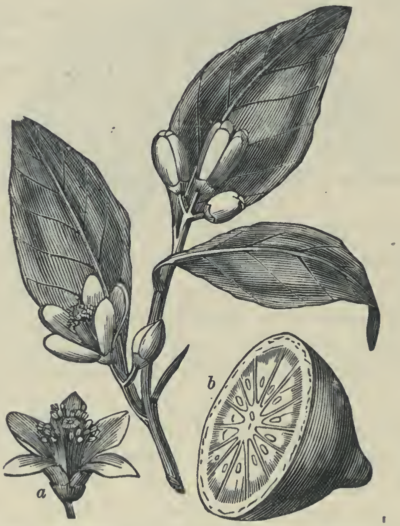


Fig. 226.—*Citrus medica,* var. *Limonum: a,* flower; *b,* fruit.

protoplasm, calcium oxalate crystals. The inner spongy white portion should be removed and discarded. *Solvents:* alcohol; wine; water. Dose, ʒss–1 (2–4 Gm.).

Commercial.—Lemons reach us from California, Florida, W. Indies, Mediterranean region (Sicily, Spain, etc.) packed in boxes, each lemon being wrapped in white or brownish tissue-paper. Foreign varieties are known as *wax, imperial, gæta,* and all, when kept several months, deteriorate, owing to the decomposition of citric acid, into sugar and carbon dioxide, in consequence of which, to insure preservation and permit long shipments, they must be coated with melted paraffin, dissolved shellac, or varnish. The rind should be pared thinly from the fruit with sharp knives and carefully dried.

CONSTITUENTS.—Volatile oil, bitter principle, hesperidin, ash 4 p. c.

Oleum Limonis. Oil of Lemon, *official.*—(Syn., Ol. Limon., Lemon Oil, Oleum de Cedro; Fr. Essence (Huile) de Citron—Cédrat; Ger. Citronöl, Limonenöl.) This volatile oil is produced mostly in Sicily, S. France, Italy (Calabria), by expression from fresh peel of the ripe fruit, using several processes that rupture mechanically the oil-cells thereby liberating the oil and rendering it easily collected: 1, *spugna*—collecting by sponge the oil from ruptured cells of the quartered rind; 2, *scorzetta*—of the halved rind; 3, *machina*—substituting a complicated machine for manual labor of expression and collection; 4, *écuelle à piquer*—not much used but consisting of an instrument, bowl-shaped, 25 Cm. (10′) wide, of tinned-copper, having a raised opening in the centre which forms with the outer edge a broad channel; to this there is a heavy cover similarly shaped, whose inner surface as well as that of the machine is armed with concentric rows of short 6 Mm. ($\frac{1}{4}$′) spikes or ridges; an opening in the bottom allows the escape of oil. By a handle the cover is made to revolve rapidly one-half minute over the instrument, having between the two 5 to 8 fruits, after which they are replaced by fresh ones. About 7000 fruits can be exhausted daily by each machine. It is a pale yellow, greenish-yellow liquid, characteristic odor and taste of lemon, sp. gr. 0.853, dextrorotatory, soluble in 3 vols. of alcohol; contains at least 4 p. c. (7–8) of aldehydes calculated as citral, $C_{10}H_{16}O$, which gives the aroma and value (being also produced by oxidizing geraniol, $C_{10}H_{18}O$, with chromic acid), limonene (citrene), $C_{10}H_{16}$, 76 p. c., little cymene, $C_{10}H_{14}$, citronellal, $C_{10}H_{18}O$, phellandrene, pinene, geranyl acetate, a sesquiterpene, octyl aldehyde, nonyl aldehyde, methyl heptenone, terpineol. Should be kept cool, dark, in well-stoppered, amber-colored bottles, and that having a terebinthinate odor must not be dispensed. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

ADULTERATIONS.—Oils of other *Citrus* fruits, fixed oils, alcohol, oil of turpentine. The fragrant *Oil of Petit Grain Citronnier,* from immature fruits, leaves, and twigs, closely resembles *Néroli Petit Grain,* and may be used similarly.

Hesperidin, $C_{22}H_{26}O_{12}$.—A glucoside (bitter principle) from the white, spongy part or rind by boiling water; bitter, yellowish-white powder or white needles; soluble in diluted alkalies or acetic acid, black with ferric salts, and by diluted sulphuric acid decomposed into hesperetin, $C_{16}H_{14}O_6$, and glucose, $C_6H_{12}O_6$.

PREPARATIONS.—I. PEEL: 1. *Tinctura Limonis Corticis.* Tincture of Lemon Peel. (Syn., Tr. Limon. Cort.; Fr. Teinture d'Écorce de Citron; Ger. Citronenschalentinktur.)

Manufacture: 50 p. c. Similar to Tinctura Aloes, page 110—macerating lemon peel 50 Gm. in alcohol 100 Ml. (Cc.), finishing with alcohol q. s. 100 Ml. (Cc.), filter through purified cotton. Dose, ʒss–2 (2–8 Ml. (Cc.)).

Prep.: 1. *Syrupus Acidi Citrici,* 1 p. c.

II. OIL: 1. *Spiritus Ammoniæ Aromaticus,* 1 p. c. 2. *Spiritus Aurantii Compositus,* 5 p. c.

Unoff. Preps.: I. PEEL: *Spirit,* 5 p. c., + oil 5 p. c. (alcohol), dose, ʒss–2 (2–8 Ml. (Cc.)). *Infusum. Syrup. Juice* (from fruit—used alone, neutralized by alkali, or made into syrup; soon spoils, but will keep a short time by lettings tand until albumin is coagulated, straining into hot bottles, and covering with almond or sweet oil; flavor is preserved best by making it into concentrated syrup); yield ½–1 ounce (15–30 Ml. (Cc.)) per lemon, dose, ʒij–5 (8–20 Ml. (Cc.)).

PROPERTIES AND USES.—Stimulant, stomachic, added usually to infusions, tinctures, etc., chiefly for flavoring. Juice refrigerant, relieves thirst, febrile inflammatory affections in agreeable beverages; diaphoretic (neutral mixture), scurvy (seamen on long voyages should take ℥j (30 Ml. (Cc.)) daily as a preventive), acute rheumatism; locally in sunburn, pruritus of scrotum, uterine hemorrhage after labor, gargle in diphtheria.

Limones, Lemons. The fruit, official 1830–1860. *Limonis Succus, Lemon Juice,* official 1860–1910.

Allied Plants:

1. *Citrus Aurantium,* var. *Bergam'ia, Bergamot.*—Volatile oil, from rind of fresh fruit, official 1840–1900; S. Italy, France; cultivated. Small tree resembling the lemon and orange, flowers peculiar, delicious odor, fruit pale lemon color, pyriform or globose, with concave receptacles of oil in the rind. Oil obtained as that of lemon and orange, and is a greenish, thin liquid, peculiar fragrant odor, aromatic bitter taste; contains limonene (citrene), dipentene (bergaptene, bergamot camphor), linalool, and linalool acetate 36–39 p. c., upon which the value chiefly depends. Stimulant, excitant, aromatic; used exclusively as a perfume.

2. *C. med'ica, Citron.*—Small tree, but fruit very large, 20–22.5 Cm. (8–9′) long, resembling pineapple in shape. The rind is popular as a dessert, essence in perfumery, and juice for similar purposes as that of lemon and lime fruits. *C. medica,* var. *acida. Succus Citri, Lime Juice;* contains citric acid 5–10 p. c. *Succus Citri et Pepsinum,* lime juice 60 p. c., + glycerite of pepsin 40.

3. *Æ'gle Mar'melos, Bela, Bael, Bengal Quince.*—Malabar, Coromandel, cultivated in India. Fruit round, size of a large orange, cherry-red color, aromatic, sweetish, acidulous, mucilaginous, astringent when unripe, laxative when ripe, seeds woolly, pulp firm, brittle,

12-celled, covered with hard, gourd-like nearly smooth rind. The dried, half-ripe fruit used, which is adulterated sometimes with fruit of *Garcin'ia Mangosta'na, Mangosteen;* contains gum, pectin, sugar, tannin, bitter principle, volatile oil. It is mildly astringent. Dose, gr. 15–30 (1–2 Gm.), in diarrhœa, dysentery.

40. SIMARUBACEÆ. Quassia Family.

Sim-a-ru-ba'se-e. L. *Simarub-a*+ aceæ; from native name in Guiana. Shrubs, trees. Distinguished by containing bitter principle, and from allied Rutaceæ, by leaves being exstipulate, without glands or dots, alternate; ovary stalked, 4–5-lobed, superior; ovules 1 in each cell; stamens 8–10, augmented each by 1 or more scales; calyx 4–5; petals 4–5; fruit drupe; seed exalbuminous; tropics; bitter, tonic, febrifuge.

Genera: **1. Picrasma. 2. Quassia.**

QUASSIA. QUASSIA.

Picrasma excelsa, (*Swartz*) *Planchon,* }
Quassia amara, *Linné.* } The wood.

Habitat. 1. W. Indies (Jamaica, St. Kitt's, Antigua, St. Vincent. 2. Surinam, W. Indies, Brazil, Guiana, Columbia, Panama.

Syn. Quass., Bitter Wood, Bitter (Ash, Bark) Quassia, Lofty Quassia, Bitterwood Tree; Br. Quassiæ Lignum; Fr. Quassia de la Jamaïque, Bois (amer) de Quassia; Ger. Lignum Quassiæ, Quassiaholz.

Pic-ras'ma. L. fr. Gr. *πικρός,* bitter—*i. e.,* the plant's chief property.

Quas'si-a. L. fr. *Quassi, Quassy, Quash,* name of Surinam negro slave who used the bark as a secret remedy in curing malignant fevers (febrifuge).

Ex-cel'sa. L. *excelsus; ex,* out, + *celsus,* beyond, surpassing—*i. e.,* highest species of the genus.

A-ma'ra. L. *amarus,* bitter—*i. e.,* the intense bitterness of the wood.

PLANTS.—*Picrasma excelsa,* tree 15–24 M. (50–80°) high, .6–1 M. (2–3°) thick, erect, spreading; bark grayish-brown, smooth, wrinkled; leaves imparipinnate, 4–5 pairs; leaflets 5–10 Cm. (2–4′) long, ovate, petiolate, when young covered with fulvous down; flowers, Oct.–Nov., small, yellowish-green, panicles, polygamous; fruit Dec.–Jan., black drupe, size of a pea; *Quassia amara,* small branching tree or shrub; flowers bright red, rather large racemes, hermaphrodite, decandrous; fruit 2-celled capsule, seed globular. WOOD (*P. excelsa*): *Jamaica,* usually in chips, raspings, shavings, occasionally in small cubes, billets 5–20 Cm. (2–8′) thick, yellowish-white, with few light gray pieces somewhat coarsely grained; fracture tough, fibrous, odor slight; taste bitter. POWDER, yellowish; microscopically—fragments with large tracheæ, single or 2–5 medullary rays 1–5 cells wide, 10–20 rows deep, calcium oxalate crystals, few starch grains, .01–.015 Mm. ($\frac{1}{2500}$–$\frac{1}{1625}$′) broad; (*Q. amara*): *Surinam,* similar to preceding, but heavier, harder, deeper colored, tracheæ usually single or 2–3–4, medullary rays narrower, larger groups, 1–4 cells wide, 10–30 rows deep, calcium oxalate crystals few or absent. *Solvents:* water; diluted alcohol. Dose, gr. 15–60 (1–4 Gm.).

Commercial.—Plants resemble our common ash and contribute two varieties: 1, *Jamaica* (*P. excelsa—Quassia* (*Simaruba*) *excelsa*), the larger, and furnishing most of the supply; 2, *Surinam* (*Q. amara*), the smaller and the original source of drug, upon which the slave Quassi established his own and its reputation, being prevailed upon to reveal his secret for compensation, 1756, when the wood was taken to Stockholm and soon became a popular remedy in Europe and elsewhere; owing to scarcity, smallness of plant, and great demand there arose the necessity of recognizing the larger and more abundant source.

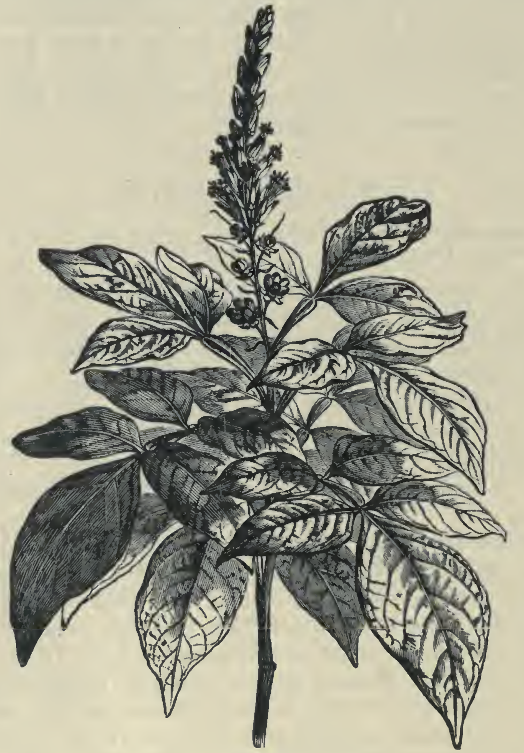


FIG. 227.—*Picrasma excelsa.*

The plants are felled, cut into segments, 1–1.2 M. (3–4°) long, 5–20 Cm. (2–8′) thick, and shipped from Jamaica or Surinam with or without the bark, and upon reaching us are turned into cups, etc., reserving the shavings for store use; the wood at first is white, but changes by age to yellow.

CONSTITUENTS.—Picrasmin (quassiin) .05–.15–.75 p. c., alkaloid (yellowish, blue fluorescence with acidified alcohol), resin, mucilage, pectin; Surinam quassia also contains trace of tannin, giving black or bluish-black with ferric salts.

Picrasmin.—Obtained by neutralizing infusion with sodium hydroxide, precipitating with tannin, decomposing precipitate by heating with lead oxide or lime, dissolving out with alcohol. It is a mixture of two crystalline compounds, *a*-picrasmin, $C_{35}H_{46}O_{10}$, and *b*-picrasmin, $C_{36}H_{48}O_{10}$, homologous with quassiin, $C_{32}H_{40}O_{10}$, of Surinam quassia, crystallizing in needles or prisms, soluble in alcohol, chloroform, water (1200). Dose (amorphous) gr. ½–1 (.03–.06 Gm.); (crystalline) gr. $\frac{1}{32}$–$\frac{1}{3}$ (.002–.02 Gm.).

PREPARATIONS.—1. *Tinctura Quassiæ.* Tincture of Quassia. (Syn., Tr. Quas.; Fr. Teinture de Quassia (amère); Ger. Quassiatinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: 33 p. c. alcohol. Dose, ♏xv–60 (1–4 Ml. (Cc.)).

Unoff. Preps.: Extract (water), dose, gr. 1–3 (.06–.2 Gm.). *Fluidextract* (alcohol 33 p. c.), dose, ♏xv–30 (1–2 Ml. (Cc.)). *Infusum Quassiæ* (Br.), 1 p. c., dose, ʒiv–8 (15–30 Ml. (Cc.)). *Liquor Quassiæ Concentratus,* 10 p. c. *Syrup,* for fly poison.

PROPERTIES.—Tonic, febrifuge, anthelmintic, simple bitter (similar to calumba).

USES.—Atonic dyspepsia, diarrhœa, gastric vertigo, constipation, loss of appetite, poisons flies (*papier mouri*), fish, dogs, rabbits. Infusion (℥viij; 240 Ml. (Cc.)), patient being in the knee-chest position, as enema for thread worms (*Oxyuris vermicularis*) or ascarides of rectum internally for lumbricoid worms. Large doses cause headache, nausea, vertigo, vomiting, diarrhœa, cramps, narcosis. Substituted for hops in making beer and ale.

Allied Plants:

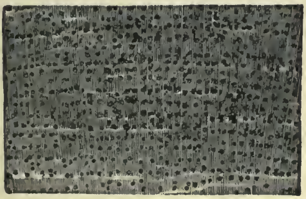


FIG. 228.—Jamaica quassia wood: cross-section magnified 3 diam.

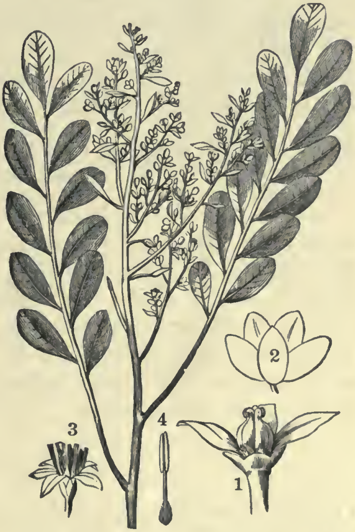


FIG. 229.—*Simaruba amara* (*officinalis*): *1,* calyx and ovary; *2,* corolla; *3,* stamens; *4,* stamen and anther.

1. *Simaru'ba ama'ra* (*S. officin-a'lis, S. medicina'lis, Quassia Simaruba*).—The bark (of root), official 1820–1880; Guiana to N. Brazil, W. Indies. Tree 15–18 M. (50–60°) high, crooked branches; leaves 22.5–30 Cm. (9–12′) long, leaflets 3–5 pairs, 5–10 Cm. (2–4′) long;

flowers yellow; fruit drupe; bark flat, curved, or quilled, .5–1 M. (20–40′) long, 3 Mm. (⅛′) thick, yellowish-brown, striate, fibrous, bitter; contains picrasmin, resin, volatile oil, calcium oxalate. Used as tonic, febrifuge, diuretic (large doses cause vomiting and purging), for dysentery, diarrhœa (*dysentery bark*), etc.; in infusion, decoction. Dose, gr. 10–30 (.6–2 Gm.).

2. *Sima′ba ce′dron* and *S. ferrugin′ea.*—Colombia, Brazil; resembles simaruba, but flowers hermaphrodite; fruit pear-shape, size of hen's egg. Used natively as febrifuge and as antidote to poisonous animal bites.

3. *Me′lia Azed′arach, Margosa Bark, Pride of India.*—Meliaceæ. The bark of the root, official 1820–1890; China, India, cultivated, S. United States. Beautiful tree 9–12 M. (30–40°) high, leaves imparipinnate; flowers lilac color; fruit drupe, yellow, size of cherries, poisonous pulp; never leafless. Bark curved or quilled, 5–7.5 Cm. (2–3′) long, 5 Mm. (⅕′) thick; outer surface reddish with irregular blackish ridges; inner surface whitish or brownish, striate, sweet, bitter, nauseous; contains resin, tannin, sugar. Used for lumbricoid worms, emetic. Dose, gr. 15–60 (1–4 Gm.), in decoction, tincture (diluted alcohol).

4. *Gua′rea (Sycocar′pus) Rus′byi, Cocillana.*—Meliaceæ, Bolivia. Bark thick, ash-color, rough by age, inner surface grayish-yellow, odor slight, peculiar, taste unpleasant, nauseous; contains rusbyine, resins (2), alkaloid, fat, tannin, ash 10 p. c. Expectorant (better than ipecac), laxative, emetic; bronchitis, bronchial pneumonia, phthisis. Dose, gr. 5–20 (.3–1.3 Gm.); fluidextract (75 p. c. alcohol).

41. BURSERACEÆ (AMYRIDACEÆ). Myrrh (Frankincense) Family.

Ber–se–ra′se–e. L. *Burser-a* + aceæ, after Joachim Burser, German botanist, at Naples, 17th century. Trees, shrubs. Distinguished by secreting fragrant gum-resinous or resinous juice; leaves compound, dotted; ovary sessile, 1–5-celled, ovules in pairs; flowers perfect; calyx 2–5 divisions; petals 3–5; stamens twice the petals; fruit dry, 1–5-celled; seed exalbuminous, superior; tropics; bitter, purgative, anthelmintic, poisonous; lumber.

Genus: **1. Commiphora.**

MYRRHA. MYRRH.

Commiphora (Myrrha), one or more species. } A gum-resin.

Habitat. E. Africa, S. W. Arabia, Somali country, around Hurrur; 450–900 M. (1500–3000°) elevation.

Syn. Myrrh, Gum Myrrh, Somali (Herabol) Myrrh, Resina Balsamodendri, Gummi-resina Myrrha; Fr. Myrrhe; Ger. Myrrha, Myrrhe.

Com-miph′o-ra. L. fr. Gr. κόμμι gum, + φέρος φέρειν bears, to bear—*i. e.*, produces gummy exudation.

Myr′rha. L. fr. Gr. μύρρα classic name—Ar. *murr;* Heb. *mar*, bitter—*i. e.*, gum-resin has bitterish taste.

Plant.—Low, stunted bush or small tree 2.5–3 M. (8–10°) high; trunk considerable size, with many irregular, knotty, abortive branches at right angles, terminating in sharp spines; bark whitish-gray; leaves trifoliate, 2.5 Cm. (1′) long, petiolate; leaflets sessile, 12 Mm. (½′) long, unequal, obovate, central one the largest; flowers diœcious; fruit 12 Mm. (½′) long, pyriform. Gum-resin (myrrh), in rounded, irregular tears or masses, brownish-yellow, reddish-brown, covered with brownish-yellow dust; fracture waxy, somewhat splintery, translucent on edges, sometimes marked with nearly white lines; odor balsamic; taste aromatic, bitter, acrid; triturated with water—brownish-yellow emulsion; with alcohol—brownish-yellow tincture, changing with nitric acid to purplish-red; macerated with water—neither swells nor dissolves. Powder, yellowish-brown; microscopically—mounts in fixed oil show many yellowish-brown angular fragments; in hydrated chloral T. S. color intensified, which with iodine T. S. reveals starch; in phloroglucinol T. S. and hydrochloric acid show few fragments of lignified sclerenchymatous fibres or stone cells. If dark colored tears used, get no purplish-red with nitric acid, hence such pieces and those dissolving completely or simply swelling in water should be rejected. *Solvent:* alcohol, in which at least 35 p. c. should be soluble. Dose, gr. 5–30 (.3–2 Gm.).

Adulterations.—Gum-resin of allied species (bdellium, etc.—fracture more transparent or opaque, odor and taste different), vegetable fragments, sand, salt, dark gums swelling or adhesive with water.

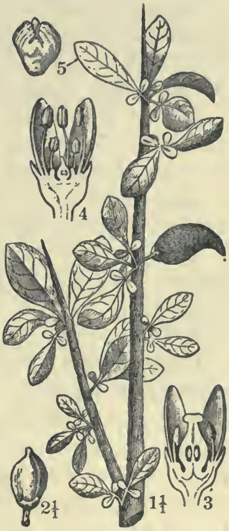


Fig. 230.—*Commiphora (Myrrha)*: *1*, fruit-bearing twig; *2*, ripe fruit; *3* and *4*, vertical section of pistillate and staminate flowers respectively; *5*, embryo.

Commercial.—Trees form an undergrowth in the Red Sea coast forests where vegetation is scant, water scarce, and temperature high. Myrrh is formed in the bark and pith, and exudes spontaneously, like cherry-tree gum, or from artificial incisions through the stem-bark, being at first a juice, then oily, soft, yellowish, golden, finally hard and reddish. It is collected mostly by the Somali, both at home and across the Aden Gulf, Arabia, and formerly entered commerce via Egypt and Lavant ports, hence the name *Turkey myrrh*, but now is conveyed to the great fair of Berbera, there purchased by the Banians of India, and shipped via Aden to Bombay, where it is assorted into grades (bdellium separated) and put into chests, 100–200 pounds (46–90 Kg.). There are three varieties: 1, *Turkey* (*African*), the best—our official kind; 2, *Arabian*, cultivated in S. Arabia, east of Aden, called by Arabs *mur*, by Somalis *mulmul*, *heerabul*, resembles the preceding, but smaller, tougher, without white lines in fracture, less resin, volatile oil and fragrance, only 25 p. c. soluble in alcohol; 3, *Indian* (*Myrrha Indica*), called natively *bissabul*, by Somalis *hebbakhade*, resembles dark myrrh, but has mushroom-like odor, strong, almost acrid, taste; contains resin 21 p. c., volatile oil 8 p. c., many impurities; in commerce as Opopanax.

CONSTITUENTS.—Volatile oil 4–8 p. c., Resin 25–40 p. c., Gum 40–60 p. c., bitter principle (glucoside, soluble in alcohol, water), ash 3–8.5 p. c.—mostly calcium carbonate.

Volatile Oil, $C_{10}H_{14}O$.—Also called *myrrhol* or *myrrhenol*, identical in formula with thymol and carvol, but distinct from them; easily resinifies, pale yellow, thick liquid, sp. gr. 0.988.

Resin, $C_{48}H_{32}O_{10}$.—Often called *myrrhin*, soluble in alcohol, chloroform, ether; consists of 2 parts—one soft the other hard and acid, the latter yielding protocatechuic acid and pyrocatechin, and further divisible into 2 parts—β and γ commiphoric acids.

Gum.—Two kinds, one soluble, the other swelling—galactose and arabinose—in water, adhesive, making stable paste; one precipitated by neutral, the other by basic lead acetate.

PREPARATIONS.—1. *Tinctura Myrrhæ.* Tincture of Myrrh. (Syn., Tr. Myrrh.; Fr. Teinture de Myrrhe; Ger. Myrrhentinktur.)

Manufacture: 20 p. c. Similar to Tinctura Aloes, page 110; menstruum: alcohol. Dose, ♏xv–60 (1–4 Ml. (Cc.)); mostly used externally.

2. *Pilulæ Rhei Compositæ*, 1 gr. (.06 Gm.).

Unoff. Preps.: Fluidextract, dose, ♏v–30 (.3–2 Ml. (Cc.)). *Compound Iron Mixture*, 1.8 p. c. *Pills of Aloes and Myrrh*, 1 gr. (.06 Gm.). *Tincture of Aloes and Myrrh*, 10 p. c. *Plaster.*

PROPERTIES.—Stimulant, tonic, expectorant, emmenagogue, astringent, carminative, vulnerary; increases circulation and the number of white blood-corpuscles; it is eliminated by the genito-urinary and bronchial mucous membranes, augmenting and disinfecting their secretions; large doses vomit, purge, decrease bronchial secretion. Locally, stimulant, disinfectant, and antiseptic to mucous membranes, ulcerated surfaces, etc.

USES.—Atonic dyspepsia, amenorrhœa, anæmia, bronchial catarrh, cystitis, pharyngitis, chronic uterine and vaginal leucorrhœa. Locally —ulcerated spongy gums, diseased mucous surfaces, relaxed throat, ptyalism, ozæna, indolent ulcers; tincture freely diluted with water a good disinfectant gargle to ulcerated sore throat; much used in tooth powders and wash.

Allied Plants:

1. *Commiphora* (*Balsamoden'dron*) *Opobal'samum, Bal'samum Gileaden'se, Balm of Gilead, Mecca Gum, Indian Bdellium.*—Greenish turbid oleoresin, rosemary odor. *C. Mu'kul* and *C. africa'na, Indian* and *African Bdellium.* Occurs in tears, yellowish-brown, dusty, translucent; resembles myrrh, but does not give purplish-red with nitric acid; both contain volatile oil, resin, gum, and the latter a bitter principle.

2. *Boswel'lia Carte'rii, Olibanum, Frankincense.*—E. Africa, S. Arabia. This gum-resin exudes from incisions made in the bark; occurs in yellowish-brown tears covered with white dust; odor balsamic, terebinthinate; taste balsamic, bitter; partly soluble in alcohol; yields with water milk-white emulsion; contains volatile oil 4–7 p. c. (mostly *olibene*, $C_{10}H_{16}$), resin 56–72 p. c., gum (resembles arabin), 30 p. c., bitter principle, ash 3. p. c. Stimulant, expectorant. Dose, gr. 15–30 (1–2 Gm.), in emulsion, plaster, or fumigation.

3. *Cana'rium commu'ne, Manila Elemi, Elemi.*—Philippine Islands. The oleoresin exudes from incisions in the bark of a tall tree; it is soft, yellowish, granular crystalline, when cold friable; odor strong, resembling fennel and lemon, terebinthinate; taste bitter, pungent; contains volatile oil 10–15 p. c., amorphous resin (*breïn*) 60 p. c. (soluble in cold alcohol), crystalline resin (*amyrin*) 25 p. c., bryoidin, breïdin, elemic acid, $C_{35}H_{46}O_4$ (crystalline). Stimulant, irritant; in plaster and ointment.

42. POLYGALACEÆ. Milkwort Family.

Pol-i-ga-la'se-e. L. *Polygal-a* + aceæ, fr. Gr. πολύς, much, + γάλα, milk—*i. e.*, believed to increase lacteal secretion in female animals. Shrubs, herbs. Distinguished by bitter, acrid properties and milky roots; flowers papilionaceous; petals 3–5, more or less united; sepals 5, of which 2 anterior are lateral, larger; petaloid, forming the wings to the flowers; stamens 8, monadelphous; ovary 2–3-celled; anthers open at apex; fruit capsular; universal; bitter, acrid, tonic, stimulant; febrifuge, astringent, emetic, purgative, diuretic, sudorific, expectorant; fruit edible, saponaceous.

Genus: **1. Polygala.**

SENEGA. SENEGA.

Polygala Senega, *Linné.* { The dried roots, with not more than 5 p. c. of stems, foreign matter.

Habitat. United States, in woods and rocky soil; Can. to S. Ca., west to Wis.

Syn. Seneg., Seneca Snakeroot, Senega Snakeroot. Seneka, or Snake Root, Rattlesnake Root, Milkwort, Mountain Flax; Br. Senegæ Radix; Fr. Polygala de Virginie; Ger. Senegawurzel.

Po-lyg'a-la. L., see etymology, above, of Polygalaceæ.

Sen'e-ga. L. fr. the Seneca (Senega) tribe, one of the five N. American Indian tribes; they inhabited W. New York and used this plant as a remedy for snake-bites.

PLANT.—Perennial herb; stems several, erect, 22.5–37.5 Cm. (9–15′) high, smooth, round, leafy, occasionally reddish or purplish below, green above; leaves 2.5–5 Cm. (1–2′) long, 12 Mm. ($\frac{1}{2}$′) wide, lanceolate, sessile, margins rough, bright green; flowers May–June, small, diadelphous, white, spike 2.5–5 Cm. (1–2′) long, calyx showy; sepals 5 (3 small, green; 2 larger, petaloid, called wings); corolla small, closed; fruit capsule, 2-celled, compressed, 2-seeded, black. ROOT, slenderly conical, more or less tortuous and branched, 3–15 Cm.

(1$\frac{1}{5}$–6′) long, 2–10 Mm. ($\frac{1}{12}$–$\frac{2}{5}$′) thick, bearing a few rootlets; crown knotty with numerous buds and short stem-bases; brownish-yellow, crown rose-tinted, longitudinally wrinkled, frequently marked by a keel; fracture short, wood pale yellow, usually eccentrically developed, and in broken pieces; odor peculiar, penetrating; taste sweetish, acrid. POWDER, yellowish-gray, odor penetrating, slightly sternutatory; microscopically—mixture of fragments of parenchyma containing oily globules and non-lignified wood-fibres with tracheæ, medullary ray cells somewhat lignified. *Solvents:* boiling water; alcohol; diluted alcohol. Dose, gr. 5–30 (.3–2 Gm.).

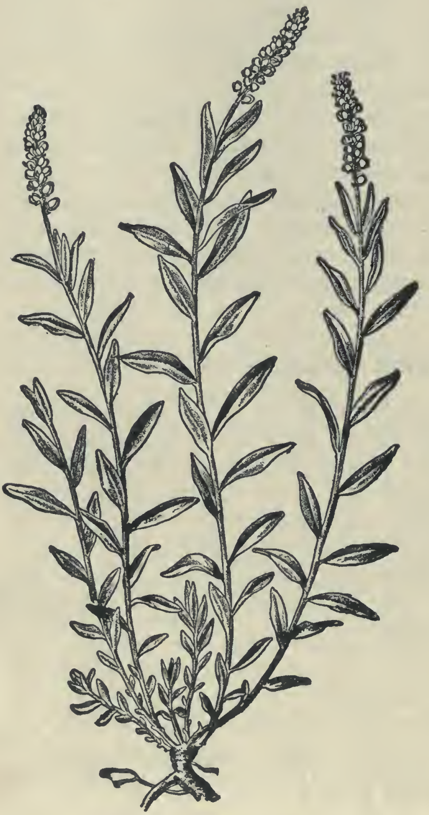


FIG. 231.—*Polygala Senega.*

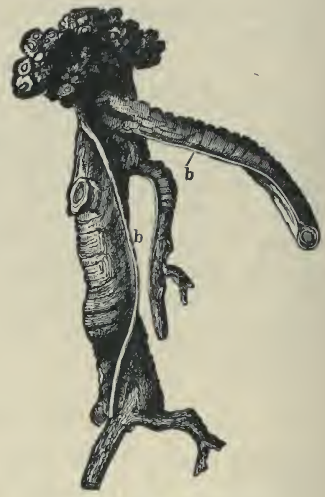


FIG. 232.—*Polygala Senega:* root, natural size; *b*, *b*, the keel.

ADULTERATIONS.—Allied species, also gillenia, triosteum (rhizome and roots), American gentians (rootlets), often to 25 p. c.—result of careless collection and intentional fraud; in Europe occasionally the underground portion of *Cynan'chum Vincetox'icum.* Of these none has a keel, some contain starch, and all differ in odor, color, and taste.

Commercial.—The official root, as well as some of the growing plants of this genus emit a slight wintergreen odor; the southern root is smaller and usually paler, while the Manitoba is larger and stouter, often dark, with purple discoloration about the crown; the large, broad-leaved form is considered var. *latifo'lia.* Root should be collected in the autumn, and comes chiefly from Minnesota and northward.

Constituents.—Saponin-like compound 5–6 p. c., composed of senegin 1.5 p. c., and polygalic acid 4 p. c. (analogous to saponin and components, quillaja-sapotoxin, quillajic acid, of quillaja), fixed oil 8–9 p. c., volatile oil .12 p. c., methyl salicylate (increasing with age), resin, polygalite, sugar 7 p. c., pectin and albuminoids 18.40 p. c., malates, yellow coloring matter, ash 4–5 p. c.

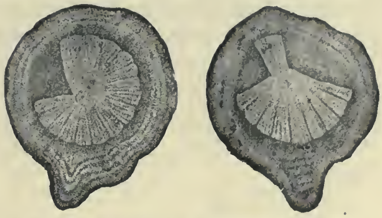


Fig. 233.—Senega: transverse sections magnified.

Senegin (*polygalin, saponin*), $C_{32}H_{54}O_{18}$.—Obtained by exhausting root with 60 p. c. alcohol, concentrating, precipitating with alcohol and ether; mother-liquor contains the salt of an organic acid. It is a neutral glucoside, white, amorphous, inodorous powder, insoluble in alcohol, not precipitated by normal lead acetate, and forms soapy emulsion with boiling water; by hydrochloric acid decomposed into glucose and sapogenin, $C_{14}H_{22}O_2$.

Polygalic Acid.—Sparingly soluble in alcohol, insoluble in ether or chloroform, precipitated by neutral and basic lead acetates.

Fixed Oil.—Obtained from root by ether; contains virgineic acid which gives disagreeable aroma.

Volatile Oil.—This is a mixture of valer(ian)ic ether and methyl salicylate.

Preparations.—1. *Fluidextractum Senegæ.* Fluidextract of Senega. (Syn., Fldext. Seneg., Fluid Extract of Senega; Fr. Extrait fluide de Polygale de Virginie; Ger. Senegafluidextrakt.)

Manufacture: Macerate, percolate 100 Gm. with alcohol 200 Ml. (Cc.) + water 100 Ml. (Cc.), proceed with menstruum (same strength) until exhausted, reserve first 80 Ml. (Cc.), evaporate remainder to soft extract, which dissolve in the reserve, add ammonia water gradually until alkaline, and menstruum q. s. 100 Ml. (Cc.). Dose, ♏v–30 (.3–2 Ml. (Cc.)).

Preps.: 1. *Syrupus Senegæ.* Syrup of Senega. (Syn., Syr. Seneg.; Fr. Sirop de Polygale; Ger. Senegasirup.)

Manufacture: 20 p. c. Mix fluidextract of senega 20 Ml. (Cc.) with syrup q. s. 100 Ml. (Cc.). Dose, ʒj–2 (4–8 Ml. (Cc.)).

2. *Syrupus Scillæ Compositus,* 8 p. c.

Unoff. Preps.: Abstract, dose, gr. 5–10 (.3–.6 Gm.). *Infusum Senegæ* (Br.), 5 p. c., dose, ʒiv–16 (15–60 Ml. (Cc.)). *Liquor Senegæ Concentratus,* 50 p. c., dose, ʒss–j (2–4 Ml. (Cc.)). *Tinctura Senegæ* (Br.), 20 p. c. (60 p. c. alcohol), dose, ʒss–j (2–4 Ml. (Cc.)).

Properties.—Stimulating expectorant, diuretic, diaphoretic, irritant. Produces throat and gastro-intestinal irritation, some salivation with inclination to cough, increased bronchial secretion; large doses vomit and purge. Insufflation causes sneezing, coughing, and nasal catarrh. Externally—an irritant to the skin. Senegin is a violent irritant, heart depressant, likewise same to vascular, nervous, and muscular systems. It is excreted by kidneys, skin, bronchial mucous membrane, all being stimulated and irritated by it.

Uses.—Secondary stage of acute and in chronic bronchitis, in typhoid pneumonia, asthma, croup, renal dropsy, promotes expectoration; no value when mucus tough and scanty, or unless the primary acute inflammation has been subdued. In amenorrhœa, give decoction two weeks before each menstruation, chronic rheumatism, rheumatic paralysis; senegin in gr. 2 (.13 Gm.) doses for uterine hemorrhage. Popular with North American Indians for rattlesnake and other snakebites.

Allied Plants:

1. *Polygala al'ba, White, Texas* or *False Senega.*—West of Mississippi River; root 6 Mm. ($\frac{1}{4}'$) thick, resembling official, but has a lighter color internally, also a cylindrical wood, and is destitute of keel; contains polygalic acid 3 p. c.; yields light-colored infusion and tincture. *P. Boyki'nii,* Southern States; like the *P. alba,* only thinner, yet some consider both to be one and the same species.

2. *P. polyg'ama* (*rubel'la*), *Bitter Polygala.*—The root and herb, official 1820–1880; Canada–Florida. Plant 15–22.5 Cm. (6–9′) high; leaves mucronate; flowers purple; keel crested, shorter than the wings; fruit 2-seeded, capsule oblong; contains bitter principle analogous to senegin; similar to *P. ama'ra* of Europe. Used as a tonic in bronchial catarrh; large doses laxative, diaphoretic.

43. EUPHORBIACEÆ. Spurge Family.

U-for-bi-a′se-e. L. *Euphorbi-a* + aceæ, Gr. Εὔφορβος well fed, fr. εὖ well, + φέρβειν to feed, after Euphorbus, physician to Juba, king of Mauritania. Trees, shrubs, herbs. Distinguished by containing acrid, milky, poisonous juice; flowers unisexual; calyx usually wanting; corolla none; ovary superior, 3-celled, ovules 2 from each cell; fruit tricoccous, 3–6-seeded capsule; temperate climates, tropics; emetic, purgative, diuretic, rubefacient, poisonous, starchy food, caoutchouc, aromatic, tonic, dyes, wood, edible roots.

Genera: **1. Croton. 2. Ricinus. 3. Stillingia.**

CROTON TIGLIUM. CROTON OIL PLANT.

Oleum Tiglii. Croton Oil, *official.*

Croton Tiglium, *Linné.* }A fixed oil expressed from the seeds.

Habitat. India, Philippine Islands, (Ceylon, Borneo, Japan, Hindustan, Moluccas); cultivated.

Syn. Purging Croton, Croton Seeds, Grana Tiglii, Grana Molucca; Ol. Tiglii; Br. Oleum Crotonis; Fr. Graine de Tilly ou des Moluque, Croton (Semence); Huile de Croton Tiglium; Ger. Granatill, Purgirkörner; Krotonöl.

Cro′ton. L. fr. Gr. κροτών dog-tick—*i. e.*, from the resemblance of the seeds.

Tig′li-um. L. fr. Gr. τιλάω to have a thin stool—*i. e.*, its medicinal property; croton plant seeds once called *grana tiglii* or *grana tilli.*

EUPHORBIACEÆ

Plant.—Small tree, 4.5–6 M. (15–20°) high, trunk crooked; bark smooth, light brown, that of branches scarred from fallen leaves; leaves 10–12.5 Cm. (4–5′) long, 5 Cm. (2′) wide, glabrous, ovate, serrate, bright green, veins prominent beneath, petioles 2.5–5 Cm. (1–2′) long; flowers, monœcious, racemes—staminate at upper part—pistillate at lower, greenish-white; fruit capsule, size of hazelnut, smooth, brownish-yellow, 3-celled (tricoccous), each cell 1-seeded, dehiscent. Seeds, 12 Mm. ($\frac{1}{2}'$) long, 8 Mm. ($\frac{1}{3}'$) wide, ovoid, caruncle inconspicuous, raphe fine, testa thin, roughish, not shiny, brittle, gray-brown, mottled or blackish, albumin oily; integuments 33–36 p. c., kernel 64–67 p. c.

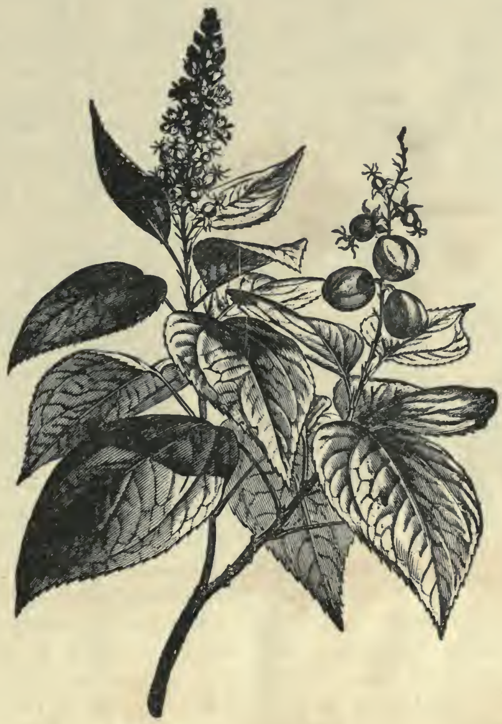


Fig. 234.—*Croton Tiglium.*

Constituents.—Fixed oil 30–40 p. c. (from entire seeds), 50–55 p. c. (from kernels alone), proteids, albumin, etc.

Oleum Tiglii. Croton Oil.—This fixed oil obtained from the seeds, deprived of shell or testa, chiefly by expression, is a pale yellow, brownish-yellow, somewhat viscid and slightly fluorescent liquid, slight characteristic odor, mild, oily, afterward acrid, burning taste (must use great caution in tasting and handling, as it produces pustular eruptions when applied to the skin), soluble in ether, chloroform, fixed or volatile oils, slightly in alcohol (when fresh in 55–70 parts, when 3–4 years old in 20 parts), acid reaction, sp. gr. 0.943, congeals at −16° C. (3.2° F.); contains glycerides of stearic, palmitic, myristic, lauric, and oleic acids, and of the volatile acids—acetic, butyric, formic, valeric, tiglic (tiglinic—oleic series), $C_5H_8O_2$, also crotonol, $C_{18}H_{28}O_4$. The purgative principle is insoluble in alcohol, the vesicating, croton-resin, $C_{13}H_{18}O_4$, is soluble, and this latter, with several inactive oily acids, constitutes crotonolic (crotonoleic) acid, closely related to oleic and ricinoleic acids, which, together with its glyceride, is believed by some to be both purgative and vesicating; it is oily, readily decomposed, slightly acid, forms salts, soluble in alcohol, severe irritant to skin and mucous membranes; croton-resin is hard, brittle, pale yellow, soluble in alcohol, ether, chloroform, vesicating property destroyed by long boiling with potassium or sodium hydroxide solution. *Tests:* 1. Heat gently with 2 vols. of dehydrated alcohol—clear solution from which the oil separates, partially or completely on cooling. 2. Shake vigorously for a few minutes 2 Ml. (Cc.) with 1 Ml. (Cc.) each of fuming nitric acid and distilled water—does not solidify, partially or completely, on standing 24 hours (abs. of other non-drying oils). Should be kept dark, in small, well-stoppered bottles. Dose, ♏$\frac{1}{3}$–2 (.02–.13 Ml. (Cc.)).

ADULTERATIONS.—Various fixed non-drying oils, castor oil, etc.

Commercial.—Plant—all parts used in India from early times; root as a drastic cathartic in dropsy; wood diaphoretic (small doses), purgative, emetic (large doses); leaves, owing to acridity, when chewed and swallowed, irritant—inflaming lips, mouth, throat and alimentary canal. Seeds most active, having been introduced into Europe, 1630, as *grana Molucca, grana tiglia,* etc., and now imported mostly for the oil which is extracted by: 1, Expression; 2, Decoction; 3, Solution (benzin, carbon disulphide, chloroform, ether). The first method is preferred, and consists in crushing and expressing the seeds without integuments at moderate temperature, thereafter digesting the marc in alcohol at 54° C. (130° F.), again expressing and reclaiming alcohol. That extracted in India, from seeds roasted slightly to separate easily the shells (using only the kernels), is pale yellow, while that extracted in Europe (also from kernels alone but from which shells have been removed without heat) is reddish-brown, due to greater age of the seeds and the higher heat employed in expression.

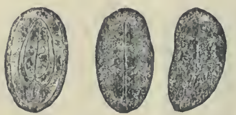


FIG. 235.—*Croton Tiglium:* lateral and ventral view and longitudinal section of seed.

PREPARATIONS.—(Unoff.) *Collodium Tiglii,* 10 p. c. *Linimentum Tiglii* (*Crotonis*), 13 p. c. *Compound Liniment,* 20 p. c. + oil of sassafras 20, oil of turpentine 20, olive oil 40. *Emulsion. Pill. Tincture;* or may give on lump-sugar.

PROPERTIES.—Powerful purgative, irritant poison, rubefacient, all due to local action; it is drastic, causing in 1–2 hours copious watery stools. Overdoses cause intense congestion of intestinal canal, vomiting, purging, possibly death from gastro-enteritis; an alkali increases its purgative effect, which is experienced often by even smelling, or rubbing the oil on the skin.

Uses.—Mania, coma, obstinate constipation, lead colic, tæniæ, dropsies, dysentery, apoplexy, paralysis. Externally—rheumatism, gout, neuralgia, glandular swellings, pulmonary and laryngeal troubles, bronchitis, ovaritis, pleurisy. Can apply the oil directly to the surface by rubbing until dry ♏j–2 (.06–.13 Ml. (Cc.)), or the same quantity dissolved in either chloroform, olive oil, soap liniment, alcohol, ether, or oil of turpentine.

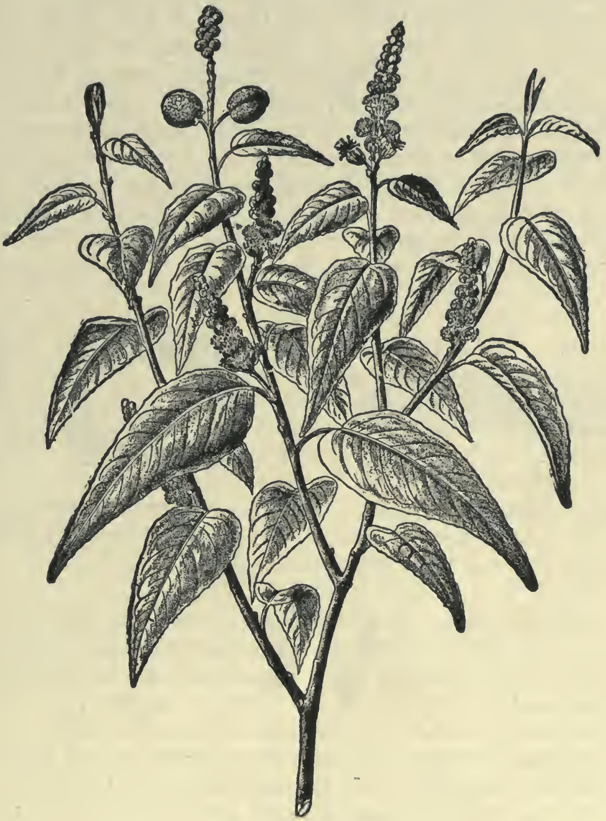


Fig. 236.—*Croton Eluteria.*

Poisoning: Have abdominal pain, great congestion of intestinal canal, vomiting, purging (fluid stools), pulse small and thready, skin moist, face pinched, prostration, collapse, death possibly from gastro-enteritis. Evacuate stomach, give milk, olive oil, mucilage, white of egg, gelatin, soup, opium, alcoholic liquids, artificial heat, hot poultice or fomentations to stomach, spirit of camphor, digitalis, warm stimulating baths.

Allied Plants:

1. *Croton Elute'ria, Cascarilla.*—The dried bark, official 1820–1900; Bahama Islands. Plant 1.5–6 M. (5–20°) high, stem, 2.5–20 Cm. (1–8′) thick, leaves 2.5–7.5 Cm. (1–3′) long, ovate, lanceolate, petiolate, under side bronzed-silver, flowers monœcious, white, odorous, fruit 15 Mm. ($\frac{3}{5}$′) thick, ovate, silvery-gray, 3-furrowed, 3-celled; bark in quills or curved pieces, 10 Cm. (4′) long, 3–8 Mm. ($\frac{1}{8}$–$\frac{1}{3}$′) broad, 1–3 Mm. ($\frac{1}{25}$–$\frac{1}{8}$′) thick, silvery-gray from lichen, or brown when this is absent, the exposed surface wrinkled, transversely fissured, inner surface reddish-brown, smooth, fracture short, resinous, thin whitish medullary rays, odor aromatic, musk-like, especially when burned, taste aromatic, bitter; contains volatile oil 1.6 p. c., cascarillin, betaine, resin 15 p. c., tannin, pectin, vanillin. Stimulant, tonic, febrifuge; intermittents, dyspepsia, diarrhœa, poor substitute for cinchona. Dose, gr. 15–30 (1–2 Gm.); tincture, 20 p. c. (alcohol 70 p. c.); dose, ʒss–2 (2–8 Ml. (Cc.)); extract, dose, gr. 5–8 (.3–.5 Gm.); infusion, 5 p. c., dose, ʒiv–8 (15–30 Ml. (Cc.)). *C. lu'cidus*, growing with the preceding plant; *C. ni'veus* (*pseudochi'na*), *Copalchi Bark*, Mexico, and *C. Malam'bo, Malambo Bark*, Venezuela. All produce barks that resemble closely.

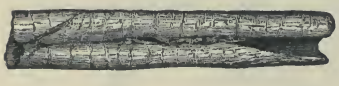


FIG. 237.—Cascarilla: bark quill.

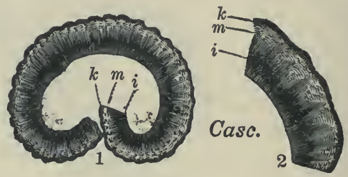


FIG. 238.—Cascarilla: *1*, cross-section enlarged; *2*, cross-section 8 times enlarged; *k*, cork; *m*, middle bark; *i*, liber.

2. *Heve'a* (*brasilien'sis* and *guianen'sis*), *Elastica, Rubber.*—The prepared milk-juice, official 1890–1910; S. America, east of Andes, India, near streams. Large trees, smooth straight trunks, 15–18 M. (50–60°) high; leaves trifoliate, leaflets obovate, 10 Cm. (4′) long, dark green; flowers racemes. Resin (rubber), in flask-shaped, roundish masses, incised pieces showing laminated structure, lighter than water, brownish-black, internally lighter, mottled, tough, elastic, odor creosote-like, almost tasteless; solvents: chloroform, carbon disulphide, oil of turpentine, petroleum benzin, benzene, melts at 125° C. (257° F.), soft and adhesive on cooling; heated with sulphur 10 p. c. —vulcanized and insoluble; with 40 p. c.—hard rubber (ebonite). Milk (resembling cow's) exudes from small pick holes, being caught in small cups, emptied into large vessels and conveyed to smoking station, where wooden paddles (lower end) are dipped repeatedly into it (then

sometimes into sand—adulteration), and rotated in a column of smoke until coagulated and mass has attained considerable size; contains resin (caoutchouc) 32 p. c., volatile oil, fixed oil. Base of plasters; woven into fabrics to compress and support relaxed muscles and parts; hard rubber in surgical implements—bougies, catheters, pessaries, specula, syringes, etc.

RICINUS. CASTOR OIL PLANT.

Oleum Ricini. Castor Oil. *official.*

Ricinus communis, *Linné.* } A fixed oil obtained from the seeds.

Habitat. India; cultivated in tropics; India, Italy, Spain, Sicily, United States.

Syn. Palma Christi, Castor Bean, Mexico Seed, Oil Plant, Oil Seed (Nut); Fr. Ricin (Graine); Ger. Wunderbaum; Ol. Ricin., Oleum Palmæ Christi; Fr. Oleum e Semini Ricini, Huile de Ricin; Ger. Ricinusöl.

Ric'i-nus. L. a bug, dog-tick—*i. e.*, from the resemblance of the seeds.

Com-mu'nis. L. common, general—*i. e.*, it is the ordinary common species.

Plant.—This is quite variable in habit and appearance—in tropics a tree 9–12 M. (30–40°) high, in warm or temperate regions a woody bush 3.6–4.5 M. (12–15°) high; in Middle United States with herbaceous stems 1.6–3 M. (5–10°) high, hollow, smooth, glaucous, purplish bloom above; leaves with blade 15–20 Cm. (6–8′) broad, palmately divided ($\frac{3}{4}$ depth) into 7–11 lanceolate, serrate segments, smooth, bluish-green, paler beneath, on long, curved, cylindrical, purplish petioles; flowers July, monœcious, large, apetalous, racemes, staminate below, pistillate above; fruit tricoccous capsule 2.5 Cm. (1′) long, blunt, greenish, deeply grooved, sometimes smooth, usually spinescent on the 3 projecting sides, 3-celled, each cell 1-seeded, which is expelled in Aug.–Sept. by capsule dehiscing into 6 valves. Seed 12 Mm. ($\frac{1}{2}$′) long, 6 Mm. ($\frac{1}{4}$′) broad, 3 Mm. ($\frac{1}{8}$′) thick, size of a coffee grain, with caruncle, raised raphe, grayish, marbled with blackish spots or bands of various tints and shapes, smooth, shining.

Constituents.—Seeds (testa 23.82 p. c., kernel 69.09 p. c.) yield fixed oil 35–45 p. c., gum (mucilage) 2.4 p. c., starch and lignin 20 p. c., albumin 5 p. c., ricinine, proteids (emulsin), sugar, ash (testa 10 p. c., kernel 4 p. c.). The poisonous principle, ricin, is an albuminoid, soluble in a 10 p. c. solution of sodium chloride, precipitated by acids, coagulated by heat; harmless to chickens.

Oleum Ricini. Castor Oil.—This fixed oil, obtained from the seeds chiefly by expression, is a pale, almost colorless, transparent, viscid liquid, faint, mild odor, bland, slightly acrid, generally nauseating taste, miscible with dehydrated alcohol or glacial acetic acid; sp. gr. 0.955; at 0° C. (32° F.) separates into crystalline flakes, at —18° C. (—.4° F.) congeals into yellow mass; contains mostly ricinolein (the glyceride of ricinoleic acid), $C_3H_5(C_{18}H_{33}O_3)$, also palmitin, ricinoleic acid (ricinic acid), $C_{18}H_{34}O_3$, which is a viscid oil readily converted by nitrous acid into ricinelaidic acid, crystalline, melting at 50° C. (122° F.). *Tests:* 1. Only partly soluble in petroleum benzin (dist. from most fixed oils). 2. Soluble (clear) in an equal volume of alcohol (abs. of foreign oils). Should be kept in well-closed containers. Dose, ʒj–8 (4–30 Ml. (Cc.)).

ADULTERATIONS.—Rare: Cottonseed, rapeseed, sesame, and mineral oils—detected by decreased solubility in alcohol and preceding tests.

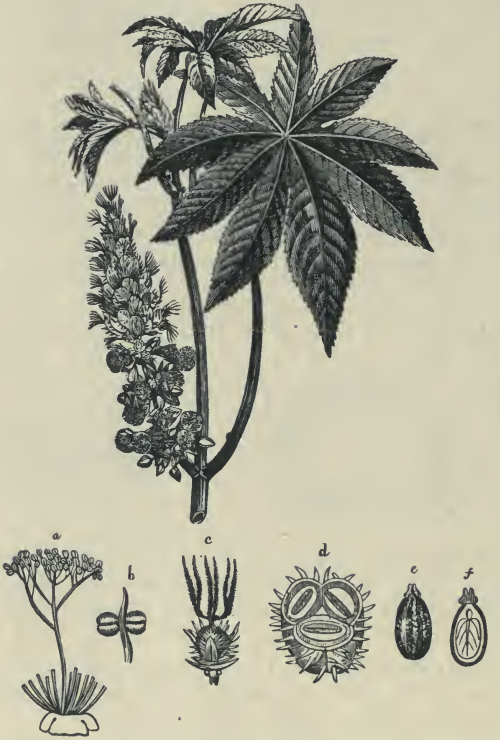


FIG. 239.—*Ricinus communis: a*, stamen; *b*, anther; *c*, stigmas; *d*, transverse section of capsule; *e*, seed; *f*, embryo.

Commercial.—Plant, called Palma Christe from supposed shape of leaves resembling Christ's hand, is cultivated extensively in the United States for the oil which is extracted from the seeds by: 1, Expression; 2, Decoction; 3, Solution (benzin, carbon disulphide, chloroform, ether). The first method is preferred, and consists in crushing and freeing seeds of the integuments, dark skin, etc., and expressing at 60° C. (140° F.), or in heating clean seeds in shallow tanks short of scorching, 65° C. (150° F.), to render oil more fluid, and expressing them hydraulically in hempen bags between hot iron plates; while this affords the greatest yield of oil it is of inferior quality, the best being from hand-screw presses. This white oil now is run into iron vats with water, boiled to separate impurities (albumin being coagulated and removed by skimming, mucilage and starch being dissolved in water), strained, reboiled (to destroy acidity), strained, and, if opaque, treated with fuller's earth, or magnesium oxide (1 p. c.) and animal charcoal (2.5 p. c.), filtered through paper and felt, and put into cans or barrels, constituting as such *cold-pressed castor oil;* by grinding marc with water and expressing may obtain 6–8 p. c. additional good oil; the yield by cold expression is 25–30 p. c., with heat 35–45 p. c. The method by decoction, owing to water dissolving poisonous ricin and heat increasing oil's acidity, is not so desirable, consisting in crushing the seeds after removing husks (testa), boiling with water (oil floating on surface), straining, reboiling to dissipate acrid principle, straining, filtering; this oil usually is brownish, acrid, irritating, and comes from E. and W. Indies. The method by solution causes the oil to turn rancid quicker, in spite of which it is preferred in France and Italy, being considered more agreeable and effective. The so-called popular Italian castor oil is produced extensively around Verona, Italy, where only fresh seeds thoroughly deprived of coating are expressed hydraulically without heat; this oil although remarkedly free from disagreeable odor and taste is none the less active. An ethereal or alcoholic tincture of the seeds is claimed to be less irritating and nauseous. The press-cake, usually 60 p. c., is employed chiefly as a fertilizer, and, after the removal of ricin by salt solution, as a cattle-food. In India there are two varieties of seeds, *large* and *small,* the latter yielding the best oil.

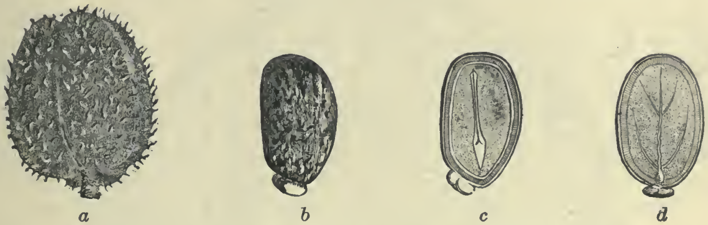


FIG. 240.—*a,* Ricinus fruit; *b,* seed; *c* and *d,* longitudinal sections.

PREPARATIONS.—1. *Collodium Flexile,* 3 p. c.

Unoff. Preps.: Aromatic Castor Oil, 97 p. c. + benzosulphinide .05, oil of cinnamon .3, oil of clove .1, vanillin .1, coumarin .01, alcohol 3. *Emulsion,* 35 p. c. *Mistura Olei Ricini* (Br.), 37.5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)). *Capsules. Paste.*

PROPERTIES.—Purgative, demulcent. It is non-irritating until the duodenum is reached, where the bile and pancreatic juice decompose it into glycerin and ricinoleic acid; this latter combines with sodium, forming sodium ricinoleate, which mildly irritates the bowels, causing purgation, stimulating muscular glands and coat, but not the liver; acts in 4 to 6 hours, producing liquid stools without much pain or tenesmus, followed by sedative effect on intestines. Leaves are said to be galactagogic when applied to breast, and to impart cathartic power to the milk and various secretions. Glycerin increases the purgative effect.

Uses.—Constipation, colic, diarrhœa, dysentery, enteritis in pregnancy, puerperal state, tape and lumbricoid worms, traumatic fever, renal calculi, night-sweats, amenorrhœa, engorged liver, hemorrhoids, cystitis, gonorrhœa. In dysentery may add laudanum, ♏xx (1.3 Ml. (Cc.)), to each dose in order to counteract any pain, tenesmus, or exhaustion from frequent passages; externally applied to warts, as a local sedative, protective; base of Turkish-red oil used in calico dyeing and printing.

Administration.—In emulsion flavored to suit, or equal quantities of oil and either heavy sarsaparilla, peppermint, or cinnamon syrup beaten together, or take with soda water, malt liquor, orange juice, coffee, etc. All disguise very effectively the nauseating oil taste. At one time the seeds were employed, but action too violent; their griping principle (ricin) is said to reside in the embryo and testa, hence to make best oil most of these should be removed before expressing.

Allied Plants:

1. *Ompha′lea oleif′era, Tambor Oil.*—C. America. Expressed from the seeds; an excellent purgative, does not gripe like castor oil.

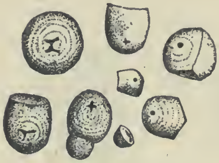


Fig. 241.—Tapioca starch.

2. *Man′ihot Manihot* (*utilis′sima*), *Tapioca.* (See page 85.)—The fecula of root (rhizome), official 1820–1880; Brazil, W. Indies. Shrub 2–2.5 M. (6–8°) high; stem jointed, petiolate leaves at upper portion, 3–5- to 7-lobed, glaucous. Root fleshy, white, tuberous, 1 M. (3°) long, weighing 20–30 pounds (9–13 Kg.). Matures in 8 months; contains poisonous (HCN) milky juice; this is pressed out and the cassava meal made into bread or washed for its starch, which is diaphanous, muller-shaped, layers indistinct, hilum near rounded end, only half size of potato starch, which furnishes the factitious tapioca. Used as nutrient, demulcent, non-irritant for convalescence, debility, asthenic diseases, in doses ℥ss–1 (15–30 Gm.), prepared with boiling water, flavored with lemon juice, sugar, vanilla, aromatics, wine, etc.

STILLINGIA. STILLINGIA.

Stillingia sylvatica, *Linné.* } The dried roots.

Habitat. S. United States, in sandy soil, pine barrens (Virginia to Florida, Louisiana).

Syn. Stilling., Queen's Root, Queen's Delight, Silver Leaf, Cock-up Hat. Marcory, Nettle Potato, Yaw Root; Fr. Stillingie; Ger. Stillingie.

Stil-lin′gi-a. L. after Benjamin Stillingfleet, English botanist, author of *Miscellaneous Tracts on Natural History*, 1759.

Syl-vat′i-ca. L. *silvaticus*, fr. *silva*, a wood, of the woods, forests—*i. e.*, grows in pine-barrens of the South.

Plant.—Perennial lactiferous herb; stem .3–1 M. (1–3°) high, erect, smooth, simple; leaves lanceolate, sessile, serrate; flowers May–June, monœcious, yellow, spikes—staminate above, pistillate below, cup-shaped glands among them; fruit round capsule, rough, greenish-brown, 3-celled, each cell 1-seeded, plant when wounded emits milky juice. ROOT, terete, unequally tapering, rarely branched, 20–40 Cm. (8–16′) long, .5–3 Cm. ($\frac{1}{5}$–1$\frac{1}{5}$′) thick; usually in cut pieces, 2–5 Cm. ($\frac{4}{5}$–2′) long, reddish-brown, longitudinally wrinkled; fracture very fibrous; internally—bark light reddish-brown, thick, spongy, finely fibrous, with numerous resin cells and easily separable from porous, radiate wood, odor distinct; taste bitter, acrid, pungent. POWDER, light reddish-brown; microscopically—numerous starch grains, .005–.035 Mm. ($\frac{1}{5000}$–$\frac{1}{725}$′) broad, numerous fragments with tabular secretion cells, containing reddish-brown, amorphous, resinous substance; fragments of tracheæ associated with wood-fibres, long, narrow bast-fibres, reddish-brown cork cells, occasionally rosette aggregates of calcium oxalate. Should be kept in tightly-closed containers, adding occasionally a few drops of chloroform or carbon tetrachloride to prevent insect attack. *Solvents:* boiling water; diluted alcohol. Dose, gr. 15–30 (1–2 Gm.).

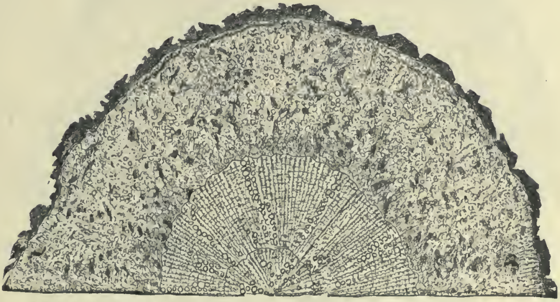


FIG. 242.—Stillingia root: magnified 10 diam.

CONSTITUENTS.—Sylvacrol, Volatile oil 3–4 p. c., resin, glucoside, fixed oil, tannin 10–12 p. c., gum, starch, ash 5 p. c.; has no alkaloid (stillingine).

Sylvacrol.—Acrid resin, to which pungency is due, soluble in alcohol, chloroform, benzin.

Volatile Oil.—Gives acrimony, odor, and taste, hence root deteriorates with age; that (oil) on the market is an ethereal extract.

PREPARATIONS.—1. *Fluidextractum Stillingiæ.* Fluidextract of Stillingia. (Syn., Fldext. Stilling., Fluid Extract of Stillingia, Fluidextract of Queen's Root; Fr. Extrait fluide de Stillingie; Ger. Stillingienfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: diluted alcohol. Dose, ♏xv–30 (1–2 Ml. (Cc.)).

Unoff. Preps.: Decoction, dose, ℥j–2 (30–60 Ml. (Cc.)). *Extract,* dose, gr. 2–5 (.13–.3 Gm.). *Compound Fluidextract,* 25 p. c., + corydalis 25, blue flag 12.5, sambucus 12.5, chimaphila 12.5, coriander 6.3, prickly ash berries 6.2, menstruum (glyc. 25, alc. 50, water 25 + dil. alc. q. s.). Dose, ʒss–1 (2–4 Ml. (Cc.)). *Compound Syrup* 25 p. c.

(comp. fldext.), glyc. 10, syrup 65, dose, ʒj–4 (4–15 Ml. (Cc.)). *Tincture*, dose, ʒss–2 (2–8 Ml. (Cc.)).

Properties.—Alterative, antivenereal; large doses emetic, cathartic. As alterative it is expectorant, diuretic, diaphoretic, sialagogue, cholagogue, increases heart action, circulation, and various secretions.

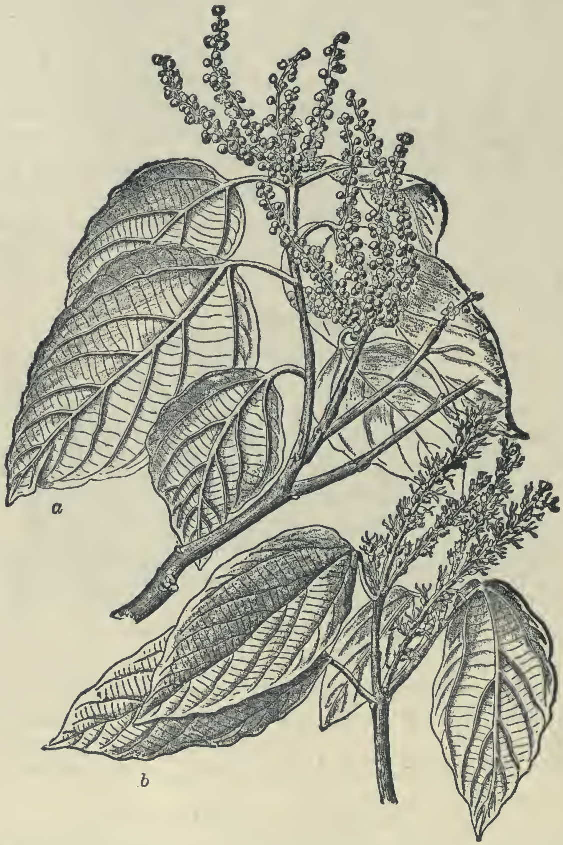


Fig. 243.—*Mallotus philippinensis: a*, twig of staminate plant; *b*, twig of pistillate plant.

Uses.—Syphilis, scrofula, skin diseases, chronic hepatic affections, intermittents, constipation; often associated with sarsaparilla. Popular in the South since 1800, when it was introduced by Dr. Simons.

Allied Plants:

1. *Stillingia sebif'era*, L. *sebum*, tallow, + *ferre*, to bear.—China. Tree 6–9 M. (20–30°) high, fruit 3-celled, 3-seeded, imbedded in solid, inodorous fat (palmitin, stearin), melts at 44° C. (112° F.), called China or Vegetable Tallow; used for candles. Grows also in S Carolina, Georgia, Florida, along seacoast.

2. *Euphor'bia corolla'ta, Flowering (Blooming) Spurge.*—The root official 1820–1880; S. United States. Perennial herb, .6–1 M. (2–3°) high; leaves lanceolate; flowers umbels, 5- (3–7-) forked, white; root many-headed, .5 M. (18′) long, 5–25 Mm. (⅕–1′) thick, blackish-brown, fissured, bark thick, white inside, sweet, bitter, acrid; contains glucoside, resin, euphorbon; yields milky juice when punctured. Used as diaphoretic (gr. 5; .3 Gm.), cathartic (gr. 10; .6 Gm.), emetic (gr. 20; 1.3 Gm.), expectorant (gr. 2–5; .13–.3 Gm.), vesicant; in infusion, decoction.

3. *E. Ipecacuan'hæ, Ipecac Spurge, Wild Ipecac.*—The root, official 1820–1880; United States. Plant resembles preceding, being a green or purple perennial, 12.5–25 Cm. (5–10′) high, stem forked from the base; leaves obovate, glabrous; flowers inconspicuous; fruit angled pod, smooth; seed white, dotted; root several-headed, .6 M. (2°) long, knotty, with stem-scars, 10 Mm. (⅖′) thick, branched, brown, wrinkled, bark thick, white inside, sweet, bitter, acrid; constituents, properties, and uses similar to preceding. *E. pilulif'era, Snake-weed, Cat's-hair,* Australia, W. Indies; small, branching, wayside annual; acts directly upon the heart and respiration, sometimes causing death; used chiefly in asthma, chronic bronchitis. Dose, ʒss–1 (2–4 Gm.), fluidextract (dil. alc.).

4. *Mallo'tus philippinen'sis, Kamala, Rottlera.*—The glands and hairs from the capsules, official 1860–1900; Philippine Islands, India, China. Small tree, 6 M. (20°) high; bark pale, branches with ferruginous tomentum; leaves 7.5–15 Cm. (3–6′) long, petiolate, ovate, entire, coriaceous, glabrous, under side rusty; flowers diœcious, tomentous; fruit tricoccous, globular capsule, size of small cherry, externally 3-furrowed, covered with red powder. Glands and hairs (kamala) glandular, mobile, brick-red powder, inodorous, nearly tasteless; under microscope as stellately arranged colorless hairs mixed with depressed globular glands, containing numerous red club-shaped vesicles; burns like lycopodium, and ash should not be more than 4–8 p. c. Capsules when collected are rolled about in baskets, and rubbed with hands to remove glands and hairs, which in turn, passing through the meshes, are caught upon cloths; contain resins (2—rottlerin, isorottlerin) 80 p. c., wax, coloring matter, albuminous matter 7 p. c., cellulose 7 p. c., ash 4 p. c. Tæniafuge (anthelmintic, purgative); tape-worm, sometimes for the round- and seat-worms; also externally in scabies, skin affections, herpetic ringworm. Next to male-fern for tænia, being better than kousso or turpentine. *Adulterations:* Powdered leaves, fruit-stalks, colored starch, earth, sand, in all sometimes 60 p. c.—increasing ash 65–75 p. c. Dose, ʒj–2 (4–8 Gm.); fluidextract, ʒj–2 (4–8 Ml. (Cc.)); tincture, 30 p. c. (alcoholic), ʒj–4 (4–15 Ml. (Cc.)); electuary; syrup; mucilage.

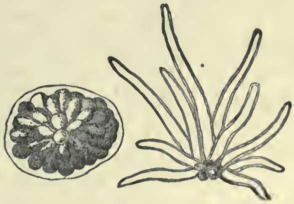


FIG. 244.—Kamala: magnified 190 diam.

5. *Flemin'gia rhodocar'pa, Wars, Wurrus.*—Ar. for saffron; Papilionaceæ; E. Africa. This is a deep purple powder, coarser than kamala, consisting of cylindrical glands and long hairs, turning black in water, odor slight; contains flemingin (resembling rottlerin), 2 resins; used as vermifuge, in skin affections, as a dye. Many fruits, as Soria, Satze (Tatze), Embelia, etc., are employed as tæniafuges, in India, Abyssinia, etc., and also the bark of *Albiz'zia* (*Acacia*) *Anthelmin'tica,* usually known as Mesenna, Mussena, Busenna—the Abyssinian names for acacia bark.

6. *Rhus' gla'bra, Sumach.*—Anacardiaceæ. The dried fruit, official 1820–1910; N. America, barren, waste fields. Woody shrub 1.5–4.6 M. (5–15°) high; stem branched, pith large, wood white, bark smooth, grayish, warty; leaves imparipinnate, leaflets 11–31, lanceolate, acuminate, serrate, light green, whitish beneath, red in autumn; flowers terminal panicles, greenish-red. Fruit drupes, clusters of crimson berries, 3–4 Mm. ($\frac{1}{8}$–$\frac{1}{6}$′) thick, glandular-tomentose, endocarp light yellow, smooth, shining; solvent: diluted alcohol; contains acid calcium and potassium malates, tannin (gallo-tannic acid) 2 p. c., gallic acid, coloring matter; galls—tannin 60–70 p. c. Astringent, refrigerant, diuretic; catarrh of stomach and bowels, pharyngitis, tonsillitis, mercurial aphthæ, spongy gums, ulcers, wounds (wash). Dose, ʒss–1 (2–4 Gm.); fluidextract (alcohol 50, water 40, glycerin 10), ʒss–1 (2–4 Ml. (Cc.)); decoction and infusion, each 5 p. c., ℥j–2 (30–60 Ml. (Cc.)). *R. aromat'ica, Fragrant* (*Sweet-scented*) *Sumach,* 1.5–2.5 M. (5–8°) high; given in extract, fluidextract (alcoholic), tincture, and for hæmaturia, leucorrhœa, but mainly for incontinence of urine (enuresis). Dose, gr. 10–30 (.6–2 Gm.). *R. copalli'na, Black, Dwarf, Mountain Sumach,* 1–2.5 M. (3–8°) high; downy branches; leaflets entire; excels all in yield of tannin. *R. hir'ta* (*typhi'na*), *Staghorn Sumach,* 4.5–9 M. (15–30°) high; hairy; leaflets serrate. All three indigenous to N. America. *R. Coria'ria, European Sumach,* Mediterranean Basin; leaflets elliptic, woolly, serrate. *R. semiala'ta* and *R. japon'ica,* China, Japan; these furnish galls which are used in Germany largely for obtaining tannic and gallic acids (see page 153). The fruits of all these are red, hairy, and acidulous, while the leaves are astringent.

7. *R. rad'icans, Rhus Toxicodendron, Poison Ivy.*—The fresh leaflets, official 1830–1900; N. America. Climbing plant over fences, rocks, trees, etc.; flowers small; fruit smooth drupe. Leaflets, collected May–June, trifoliate, petiolate, entire, glabrous, the 2 lateral nearly sessile, 10 Cm. (4′) long, obliquely ovate and pointed; when dry brittle, inodorous, astringent, when fresh with acrid juice blackening on exposure, applied to skin produces swelling, inflammation, etc. —hence should not handle ungloved or confound with the harmless *Pte'lea trifolia'ta, Three-leaved Hoptree,* whose leaflets are sessile, thicker, paler green; contains toxicodendrol 3.3 p. c., tannin, acetic acid (formerly considered toxicodendric acid); toxicodendrol, the active, irritating, poisonous principle, is a viscid, non-volatile oil (or freed fat acid, or complex glucoside), agreeably odorous, soluble in alcohol,

benzene, ether, chloroform, decomposed by heat. Irritant, rubefacient, narcotic, poisonous; internally produces gastro-intestinal inflammation, vertigo, nausea, muscular debility, delirium, mydriasis, convulsions, death. *Poisoning:* The fresh leaves, juice or flying pollen produce external itching, burning, redness, tumefaction, vesication, desquamation, lasting 1–2 weeks. Apply at once soap and water with scrubbing-brush, lead water, alkaline solutions (sodium bicarbonate —8 p. c. solution 3–4 times daily, sulphite, chlorinated, diluted ammonia, soapsuds, alum curd), tincture or infusion of lobelia, grindelia, or sassafras, cocaine solution 4–8 p. c. (to relieve burning and itching), aristol, glycerite of phenol, opium—no oils, vaselin, alcohol, these being solvents of poison serve to disseminate it, low diet, saline purgatives, quietness. Used in chronic eczema, skin diseases, erysipelas, rheumatism, incontinence of urine, etc. Dose, gr. 2–5–15 (.13–.3–1 Gm.); tincture (fresh leaves bruised and macerated with equal weight of alcohol), ♏$\frac{1}{10}$–1 (.006–.06 Ml. (Cc.)); juice (expressed from leaves and preserved with alcohol) is soluble in ether and possesses all the virtues of the plant; fluidextract, ♏v–30 (.3–2 Ml. (Cc.)). *R. Toxicoden'dron*, properly more or less shrubby, .6–1 M. (2–3°) high, erect, leaflets crenately lobed, pubescent, called also Poison Ivy

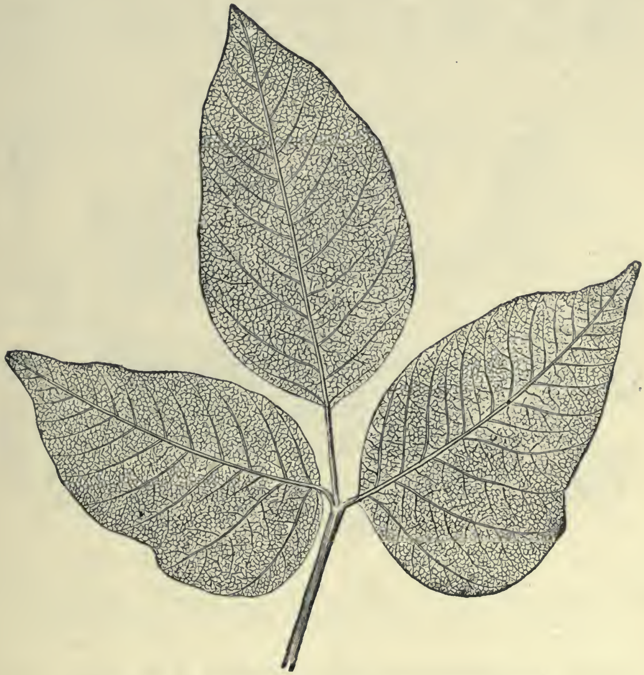


FIG. 245.—*Rhus radicans:* leaf one-half natural size.

(Oak)—merely a variety of *R. radicans*. *R. diversi'loba*, Pacific coast; leaves with 3–5-lobed, pinnatifid leaflets. *R. Ver'nix* (*venena'ta*), Canada, United States, swamps, 3–6 M. (10–20°) high; leaves of 7–13 entire leaflets; fruit yellow; called poison-sumach, -dogwood, -elder, and yields most toxicodendrol. *R. pu'mila*, S. Carolina, procumbent shrub; leaves pinnate with 11 toothed acuminate leaflets; fruit red, hairy. All of these are poisonous, but *R. Vernix* the most so, as when in flower it so taints the surrounding air that sensitive persons become poisoned by simple exposure to the effluvium.

8. *Pista'cia Lentis'cus, Mastiche, Mastic.*—The concrete resinous exudation, official 1840–1910; Mediterranean Basin (Spain, France, Italy, Morocco, Greece, etc.), Island of Scio, Grecian Archipelago, etc. Small tree, 3–4.6 M. (10–15°) high, branched, bark smooth, brownish-gray; leaves paripinnate; leaflets 3–5 pairs, lanceolate, entire, mucronate, sessile; flowers small, diœcious; fruit drupe, 6 Mm. ($\frac{1}{4}'$) thick, orange-red. Resin (mastic), subglobular, lenticular tears, 3 Mm. ($\frac{1}{8}'$) long, pale yellow, greenish-yellow, transparent, glass-like lustre, surface often dusty, brittle, plastic when chewed; odor slight balsamic; taste mild, terebinthinate; loses plasticity and deepens in color with age. Secretes in long ducts in the bark from which it is obtained by making longitudinal or transverse incisions in stem and branches, whereupon it slowly exudes, becoming within 2–3 weeks sufficiently hard to be collected carefully in soft-lined baskets. There are two varieties: 1, Separate tears (best, the once official kind); 2, Agglutinated tears (allowed to run to the ground, often collected with sand, bark, etc.—inferior); yield 10 pounds (4.5 Kg.), per plant; solvents: chloroform, ether; alcohol dissolves 90 p. c.; contains vola-

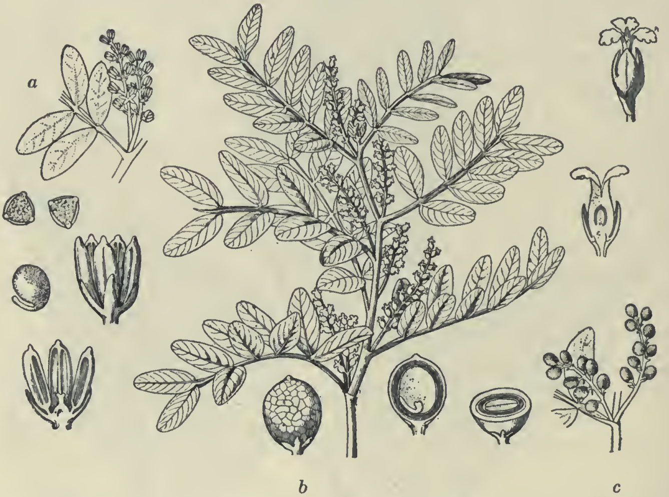


Fig. 246.—*Pistacia Lentiscus: a*, staminate branch; *b*, pistillate branch; *c*, fruit branch, $\frac{1}{4}$ nat. size; also flowers, pistil, pollen, fruit, and embryo, enlarged.

tile oil 1–2 p. c., alpha-resin (mastic(h)ic acid) 90 p. c., beta-resin (masticin), soluble in ether, oil of turpentine, bitter principle. Stimulant, diuretic, protective (solution); bronchial, vesical catarrhs, toothache (saturated ethereal solution in cavity allowed to harden), masticatory (preserves teeth), fumigation; in alcohol, oil of turpentine as varnish for maps, etc.; seldom used internally.

9. *Euon'ymus atropurpu'reus, Wahoo.*—Celastraceæ. The dried bark of the root, official 1860–1910; United States, east of the Mississippi. Ornamental shrub, 1.5–4.6 M. (5–15°) high; wood white; leaves oval, serrate; flowers dark purple cymes; fruit smooth, 4-lobed crimson capsule. Bark, curved pieces, 3–7 Cm. ($1\frac{1}{5}$–3′) long, .5–5 Mm. ($\frac{1}{50}$–$\frac{1}{5}$′) thick, ashy-gray, patches of soft cork; inner surface whitish; odor distinct; taste sweetish, bitter, acrid; stem-bark yields greenish-gray powder (chlorophyll); solvents: hot water, diluted alcohol; contains euonymin, volatile oil 1.3 p. c., resins, atropurpurin, fixed oil, bitter extractive. Laxative, diuretic, tonic, antiperiodic, expectorant; constipation, torpid liver, dropsy, pulmonary affections; overdoses—gastro-intestinal irritant. Dose, ʒss–1 (2–4 Gm.); decoction, 5 p. c., ℥j–2 (30–60 Ml. (Cc.)); extract (80 p. c. alcohol), gr. 1–6 (.06–.4 Gm.); fluidextract (80 p. c. alcohol), ʒss–1 (2–4 Ml. (Cc.)); infusion, euonymin (Eclectic; root-bark—brownish; stem-bark —greenish), gr. $\frac{1}{2}$–3–6 (.03–.2–.4 Gm.). *E. america'nus, Strawberry Bush,* low or trailing bush, with crimson capsules. *E. europæ'us,* common *Spindletree* of hedges, 2.5–6 M. (8–20°) high, cultivated, flowers greenish-yellow, capsules pale red, arillus orange-red; emetic, purgative. Both poisonous to cattle.

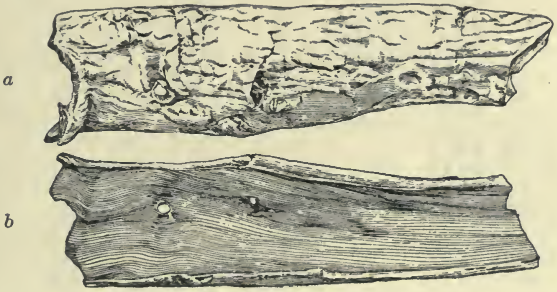


FIG. 247.—*Euonymus atropurpureus: a,* outer surface of root-bark; *b,* inner surface of root-bark, nat. size.

10. *I'lex verticilla'ta* (*Pri'nos verticilla'tus*), *Prinos, Black Alder, Winter-berry.*—Ilicaceæ. The bark, official 1820–1890; N. America, swamps; shrub, 2–2.5 M. (6–8°) high; leaves serrate, pubescent beneath; flowers white; fruit scarlet berry, size of pea. Bark thin, fragments 1 Mm. ($\frac{1}{25}$′) thick, brown-ash color, with white patches, black dots and lines; inner surface greenish, striate, bitter, astringent; contains, tannin, resin, bitter principle. Used as astringent, tonic, alterative, febrifuge, substitute for cinchona; diarrhœa, fevers, ulcers, etc. Dose, ʒss–1 (2–4 Gm.), in decoction, fluidextract.

RECAPITULATION No 4.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
1. Santalum Rubrum. 2. Red Saunders.	Pterocarpus santalinus.	The heart-wood.	S. Asia, Madras.	Santalin, santal, pterocarpin, homopterocarpin.	....	Astringent.	Dyeing, for coloring tinctures, ointments, etc.	
1. Kino. 2. Kino.	Pterocarpus Marsupium.	The spont. dried juice.	E. Indies.	Kino-tannic acid, kino-red, pyrocatechin, kinoin, gum.	Tincture.	Astringent, tonic, hæmostatic.	Diarrhœa, menorrhagia, leucorrhœa, ulcers, sore throat.	Grains. 5–20 (.3–1.3 Gm.).
1. Glycyrrhiza. 2. Glycyrrhiza (Licorice Root).	Glycyrrhiza glabra, var. typica, and glandulifera.	The dried rhizome and root.	S. Europe, W. Asia.	Glycyrrhizin, glycyramarin, asparagin, resin, starch, tannin.	Extr., pil. Fe. iod., tro. cub., tro. am. cl., pure extr., mist. g. co., fldext. cas. sag. ar., fldext., elix., syr. sars. co., am. gly., pulv. g. co., fldext. sars. co., mass. hyd., tr. aloes.	Demulcent, expectorant, laxative.	Catarrhs, bowel and urinary affections, coughs, colds.	15–60 (1–4 Gm.).
1. Sparteinæ Sulphas. 2. Sparteine Sulphate.	Cytisus Scoparius.	The alkaloidal salt from tops.	W. Asia, S. and W. Europe (U. S.).	TOPS: Volatile oil, sparteine, scoparin, tannin, fat.	....	Cardiac stimulant, narcotic.	Cardiac dropsies, asthma, palpitation.	$\frac{1}{6}$–$\frac{1}{2}$ (.01–.03 Gm.).
1. Chrysarobinum. 2. Chrysarobin.	Vouacapoua Araroba.	A mixture of neutral principles.	Brazil.	$C_{30}H_{26}O_7$.	Ointment.	Irritant.	Parasites, ringworm, psoriasis, eczema, hemorrhoids.	$\frac{1}{8}$ (.008 Gm.).
1. Physostigma. 2. Physostigma.	Physostigma venenosum.	The dried, ripe seeds.	W. Africa.	Physostigmine, eseridine, calabarine, starch, phytosterin, fat.	Extr., tinct., physostigmine salicylate.	Sedative, myotic, poisonous, emetic, purg., diaphoretic.	Tetanus, paralysis, chorea, gastralg., convuls., strych. and atrop. poisoning.	1–4 (.06–.26 Gm.).
Linaceæ: 1. Linum. 2. Linseed (Flaxseed).	Linum usitatissimum.	The ripe seed.	Levant, S. Europe (United States).	Fixed oil, mucilage, proteids, amygdalin, resin.	....	Demulcent, emollient, diuretic.	Internal inflammations, catarrh, dysentery.	60–120 (4–8 Gm.).
1. Oleum Lini. 2. Linseed Oil.	....	The fixed oil.	....	Linolein, glycerides of palmitin, myristin, and olein.	Lin. cal., liq. cresol. co.	Demulcent, laxative.	Piles, erysipelas.	Minims. 240–960 (15–60 Ml. (Cc.)).
Erythroxylaceæ: 1. Cocaina. 2. Cocaine.	Erythroxylon Coca.	The alkaloid from leaves.	S. America (Peru, Bolivia).	LEAVES: Cocaine, hygrine, benzoylecgonine, cinnamylcocaine, truxilline, tannin.	Cocaine hydrochloride.	Stimulant, tonic, diaphoretic, narcotic, anæsthetic.	Wasting diseases, convalesc., stomatitis, bronchi., surgery.	Grains. $\frac{1}{8}$–2 (.008–.13 Gm.).
Zygophyllaceæ: 1. Guaiacum. 2. Guaiac.	Guaiacum: officinale, sanctum.	The resin of the wood.	W. Indies, Northern S. America.	Guaiaretic acid, guaiaconic acid (resin), guaiacic acid, guaiac-yellow.	Tincture, ammoniated tincture.	Alterative, stimulant, diaphoretic.	Syphilis, rheumatism, scrofula, skin affections.	5–30 (.3–2 Gm.).

Rutaceæ:								
1. Xanthoxylum. 2. Xanthoxylum.	Xanthoxylum: americanum, Clava-Herculis.	The dried bark.	N. America.	Resins, xanthoxylin-e, vol. oil, tannin.	Fluidextract.	Alterative, stimulant, emmenagogue, sialagogue.	Rheumatism, dropsy, syphilis, pharyngitis.	10–30 (.6–2 Gm.).
1. Pilocarpus. 2. Pilocarpus.	Pilocarpus: Jaborandi, microphyllus.	The dried leaflets.	S. America (Brazil).	Pilocarpine, isopilocarpine, jaborine, vol. oil, resin, salts, acid.	Fluidextract, pilocarpine hydrochloride.	Diaphoretic, sialagogue, myotic, emetic, cardiac depressant.	Dropsy, rheumatism, pleurisy, coryza, Bright's disease, eye affections.	15–30 (1–2 Gm.).
2. Buchu. 2. Buchu.	Barosma: betulina, serratifolia.	The dried leaves.	S. Africa.	Volatile oil, barosmin, diosphenol, resin.	Fluidextract.	Diuretic, stimulant, tonic, diaphoretic.	Urinary troubles, bladder catarrh, etc., feeble digestion.	15–30 (1–2 Gm.).
1. Aurantii Amari Cortex. 2. Bitter Orange Peel.	Citrus Aurantium, var. amara.	The dried rind of the fruit.	N. India.	Volatile oil (naringen, aurantiamarin), hesperidin, fixed oil, tannin, resin.	Fluidextr., tinct., tr. cinch. co., tr. gent. co. (*Ol. aur. flo.*): aqua, aq. fortior, syr.	Stimulant, tonic, carminative, stomachic, flavor.	Indigestion, flatulence, corrigent to purgatives.	15–30 (1–2 Gm.). oil. ♏j–5 (.06–.3 Ml. (Cc.)).
1. Aurantii Dulcis Cortex. 2. SweetOrangePeel.	Citrus Aurantium.	The rind of the fresh fruit.			Syr., tinct., *Oil:* sp. comp., elix. aro.			
1. Limonis Cortex. 2. Lemon Peel.	Citrus medica, var. Limonum.	The outer rind of the fresh ripe fruit.	N. India.	Volatile oil, bitter principle, hesperidin.	Tinct., *Oil:* spiritus aurantii comp., spt. ammon. ar.	Stimulant, stomachic, flavor.	Indigestion.	Grains. 30–60 (2–4 Gm.).
Simarubaceæ:								
1. Quassia. 2. Quassia.	Picrasma excelsa, Quassia amara.	The wood.	W. Indies, Surinam.	Picrasmin (quassiin), resin, alkaloid, mucilage.	Tincture.	Tonic, febrifuge, anthelmintic, bitter.	Dyspepsia, diarrhœa, constipation, loss of appetite.	15–60 (1–4 Gm.).
Burseraceæ:								
1. Myrrha. 2. Myrrh.	Commiphora (Myrrha), one or more species.	The gum-resin.	E. Africa.	Volatile oil, resin, gum, bitter principle.	Tincture, pil. rhei comp.	Stimulant, tonic, expectorant, emmenagogue, vulnerary.	Dyspepsia, amenorrhœa, anæmia, pharyngitis, diseased gums, ulcers, disinfectant.	5–30 (.3–2 Gm.).
Polygalaceæ:								
1. Senega. 2. Senega.	Polygala Senega.	The dried roots.	United States.	Senegin, polygalic acid, fixed oil, vol. oil, resin, pectin, malates.	Fluidextract, syrup, syrup squill comp.	Expectorant, diuretic, diaphoretic.	Bronchitis, croup, asthma, renal dropsy, rheumatism, pneumonia, amenorrhœa.	5–30 (.3–2 Gm.).
Euphorbiaceæ:								
1. Oleum Tiglii. 2. Croton Oil.	Croton Tiglium.	The fixed oil.	India, Philippine Islands.	Glycerides of stearic, palmitic, myristic, lauric, oleic, formic, acetic, tiglinic, valeric acids, crotonol, croton-resin, crotonolic acid.	....	Powerful purgative, irritant, rubefacient.	Mania, constipation, tæniæ, dropsies, dysentery, paralysis, rheumatism, swellings, pneumonia, ovaritis, pleurisy.	Minims. ¼–2 (.02–.13 Ml. (Cc.)).
1. Oleum Ricini. 2. Castor Oil.	Ricinus communis.	The fixed oil.	India, Europe.	Ricinolein, palmitin, ricinoleic acid.	....	Purgative, demulcent.	Constipation, colic, diarrhœa, enteritis, worms, fevers, calculi, amenorrhœa, cystitis, gonorrhœa.	60–480 (4–30 Ml. (Cc.)).
1. Stillingia. 2. Stillingia.	Stillingia sylvatica.	The dried roots.	United States.	Sylvacrol, vol. oil, resin, glucoside, fixed oil, tannin.	Fluidextract.	Alterative, antivenereal, emetic, cathartic.	Syphilis, scrofula, skin diseases, liver affections, intermittents, constipation.	Grains. 15–30 (1–2 Gm.).

44. SAPINDACEÆ. Soapberry (wort) Family.

Sap-in-da'se-e. L. *Sapind-us* + aceæ, fr. *sap*(*o*) + *ind*(*ic*)*us*, Indian soap—*i. e.*, from its saponaceous fruit. Trees, shrubs, herbs, often twining. Distinguished by presence of a saponaceous principle; ovary usually 3-celled, rarely 2–4, united at base only; leaves compound, often dotted; style undivided or 2–3-cleft; sepals and petals 4–5; stamens 8–10, distinct or monadelphous, inserted on fleshy disk; fruit fleshy or capsular; seed exalbuminous, superior; tropics; astringent; aromatic, diuretic, diaphoretic, aperient, poisonous; lumber.

Genus: **1. Paullinia.**

GUARANA. GUARANA.

Paullinia Cupana, *Kunth.* { A dried paste consisting chiefly of the crushed seeds, containing 4 p. c. of caffeine.

Habitat. N. and W. Brazil, Guiana, Venezuela—banks of Tapajos and Rio Nigro Rivers; cultivated chiefly along the Itenez River.

Syn. Brazilian Cocoa, Guarana Bread; Fr. Guarana; Ger. Pasta Guarana.

Paul-lin'ia. L. after C. F. Paullini (1643–1712), a German botanist and writer.

Cu-pa'na. L. after Father Francis Cupani, Italian monk, botanist, and author; did much work on this family; died 1710.

Gua-ra'na. L. of native Brazilian name, fr. *guaranis, guarana, guarani,* a tribe of South American Indians; often pronounced gua-ra-na'.

Plant.—Climbing shrub; stem woody, angular; leaves imparipinnate; leaflets 2 pairs and an odd one, 12.5–15 Cm. (5–6′) long, 5–7.5 Cm. (2–3′) broad; flowers yellowish, spicate panicles, 10–15 Cm. (4–6′) long; fruit Oct., size of a grape, small horse-chestnut, ovoid, pyriform, 6-ribbed, splitting into 3 divisions, exposing 3 rounded seeds, size of filberts; seeds filling the fruit; arillus white, membranous; testa thin, brittle, flattish-convex, brownish-black. Paste (guarana), usually in cylindrical sticks, 3–5 Cm. (1⅕–2′) thick, elliptical cakes, dark reddish-brown, hard, heavy; fracture uneven, often fissured in the centre; internally pale reddish-brown, showing coarse fragments of seeds with blackish-brown integuments; odor slight; taste slightly astringent, bitter. Powder, light pinkish-brown; microscopically—irregular masses of parenchyma with altered starch grains, sclerenchymatous cells; few altered and unaltered starch grains .01–.025 Mm. ($\frac{1}{2500}$–$\frac{1}{1000}$′) broad. *Test:* 1. Place .001 Gm. on slide, + a drop of hydrochloric acid, + a drop of gold chloride T. S., let stand —caffeine crystals and gold chloride separate in orthorhombic plates (needles). *Solvent:* alcohol (75 p. c.). Dose, gr. 15–60 (1–4 Gm.).

Commercial.—Plant is a vine cultivated extensively and trained upon stakes or trellises. Guarana is prepared by washing from seeds the mucus-like coating, drying or roasting slightly to make the kernel shrink from testa, removing the latter by putting seeds into bags, beating with sticks and winnowing; kernels are broken up on heated stones or in wooden mortars (hollowed stumps), avoiding iron, kneaded into dough with water, or exposure to dew, adding sometimes small amounts of cacao powder or tapioca to aid cohesion, then molded into rolls or other forms and dried slowly by sun or fire on wooden gratings of bamboo strips; too rapid or irregular drying, or improper fuel, impairs flavor, and too slow admits of molding or fermentation.

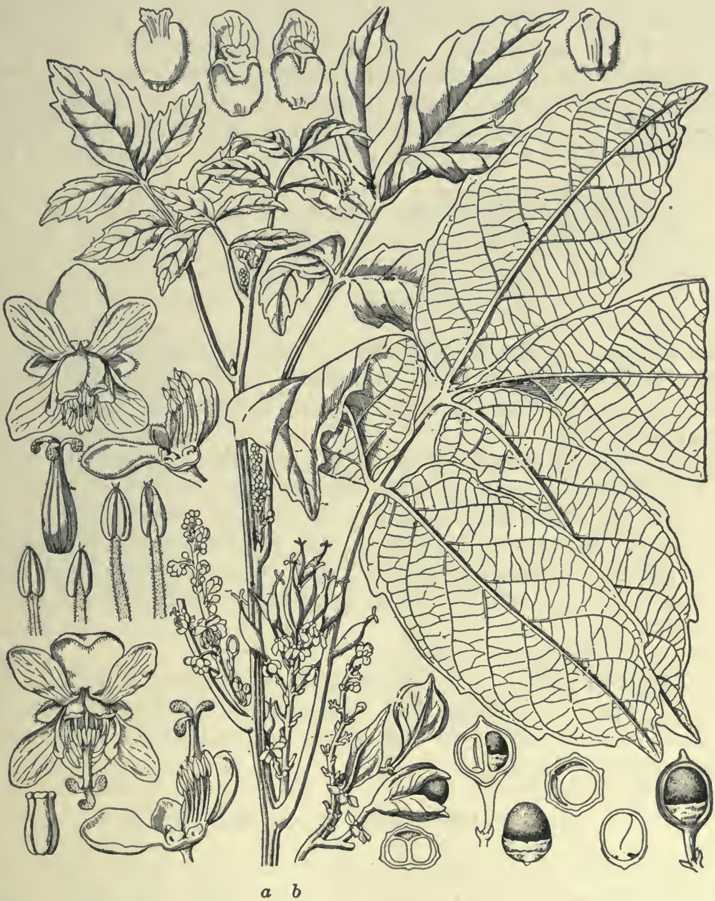


Fig. 248.—*Paullinia Cupana: a*, leafy branch with flowers; *b*, branch with ripe fruit, ¼ nat. size; also male and hermaphrodite flowers, pistil, stamens, and fruit, enlarged.

Constituents.—Caffeine (guaranine) 3–5 p. c., Tannin 26 p. c., resin, volatile oil, fixed oil, catechin, saponin, starch, gum, ash 2–5 p. c.

Caffeine.—Obtained by boiling for a considerable time powdered paste with litharge and water, adding near the end of the process a few drops of lead subacetate solution to hasten subsidence of insoluble matter; pass hydrogen sulphide through filtered solution to precipitate lead, evaporate filtered solution to get rid of hydrogen sulphide and sulphur, then allow caffeine to crystallize out.

Tannin (*paullini-tannic, catechu-tannic acid*).—Precipitates ferric salts (blackish-green), gelatin, alkaloidal and barium salts, but neither tartar emetic nor copper sulphate; reduces silver and gold salts.

Preparations.—1. *Fluidextractum Guaranæ.* Fluidextract of Guarana. (Syn., Fldext. Guaran., Fluid Extract of Guarana; Fr. Extrait fluide de Guarana; Ger. Guaranafluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: 75 p. c. alcohol; reserve first 80 Ml. (Cc.), in which dissolve soft extract, assay and add enough 75 p. c. alcohol for the 100 Ml. (Cc.) to contain 3.6–4.4—4 Gm. of caffeine. Dose, ♏xv–60 (1–4 Ml. (Cc.)).

Unoff. Preps.: Elixir, 20 p. c. (fldext.), + aromatic elixir 20, compound elixir of taraxacum q. s. 100. *Extract,* dose, gr. 2–5 (.13–.3 Gm.). *Infusion,* 5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)). *Syrup,* dose, ʒij–4 (8–15 Ml. (Cc.)). *Tincture* (extract 1 part + alcohol 30), dose, ʒj–4 (4–15 Ml. (Cc.)).

Properties.—Nervine, stimulant, tonic, astringent. Similar to coffee, tea, and maté. Produces gayety, restlessness, quick perception, wakefulness; slows pulse, impairs appetite, occasions vesical irritation.

Uses.—Chiefly in nervous sick headache (migraine), such as occurs with menstruation or following a debauch, attended with bloodshot eyes and throbbing head; diarrhœa of phthisis, convalescence, tonic in general. The native Indians use the powder mixed with cassava or chocolate as a food, or suspend it in sweetened water and allow fermentation to take place, thus furnishing a very popular yellow beverage.

Allied Plants:

1. *Sapindus margina'tus, S. Sapona'ria, Wild China Tree,* S. United States. Fruit, resembling that of Azedarach, used as antipenodio. Fruits of many species of this genus substituted for soap—soapberries—in the tropics.

45. RHAMNACEÆ. Buckthorn Family.

Ram-na'se-e. L. *Rhamn-us* + aceæ, Gr. *ῥάμνος*, the buckthorn, Christ's-thorn, fr. Celtic *ram,* a tuft of branches—*i. e.,* collection of thorns, some species thorny. Trees, shrubs. Distinguished by spiny habit; calyx 4–5-parted; petals and stamens distinct, perigynous, 4–5, opposite each other; sepals valvate; petals involute; ovary 2–5-celled, superior or inferior; fruit dry or fleshy, 2–4-celled, each cell 1-seeded; universal; acrid purgative, bitter tonic, febrifuge, dyes; fruits edible.

Genus: **1. Rhamnus.**

FRANGULA. FRANGULA.

Rhamnus Frangula, *Linné.* } The dried bark.

Habitat. Europe, N. Asia; hedges, bushy places.

Syn. Frang., Buckthorn Bark, Alder (European) Buckthorn, Black (Alder) Dogwood, Berry alder, Arrow Wood, Persian Berries; Fr. Bourdaine (Écorce de), Bourgène; Ger. Faulbaumrinde.

Rham'nus. L. see etymology, page 384, of Rhamnaceæ.

Frang'u-la. L. fr. *frango, frangere,* to break—*i. e.,* from its brittle stems—its medieval name.

Plant.—Slender, straggling bush, 3–4.5 M. (10–15°) high; branches not terminating in spines, not thorny; leaves oval, entire, 2.5–6 Cm. (1–$2\frac{2}{5}$′) long, rounded at base, pointed at apex; flowers May–June, greenish to whitish-pink; fruit July, berry size of a pea, green, then white, pale yellow, pink, red, finally black, 2–3-seeded. Bark, in quills of variable length, frequently flattened, crushed, .5–1 Mm. ($\frac{1}{50}$–$\frac{1}{25}$′) thick, purplish-black with many prominent, lighter-colored transverse lenticels and occasional patches of foliaceous lichens bearing small, blackish apothecia; inner surface smooth, dark brown with occasional purplish blotches, longitudinally striate, red with solutions of alkalies; fracture short, inner layer slightly fibrous; odor distinctive; taste slightly bitter. Powder, yellowish-brown; microscopically—no stone cells (dif. from *R. Purshiana*); fragments of parenchyma,

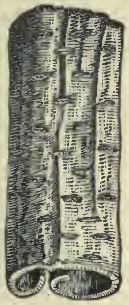


Fig. 249.—*Rhamnus Frangula:* bark, natural size.

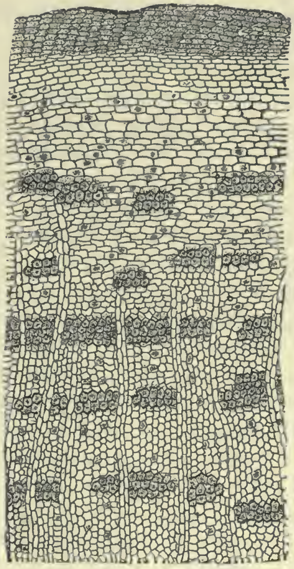


Fig. 250.—Frangula bark: transverse section, magnified 80 diam.

cork, numerous rosette aggregates of calcium oxalate and starch grains .003 Mm. ($\frac{1}{8325}'$) broad, cells of parenchyma, bast-fibres, medullary rays. *Tests:* 1. Shake occasionally until cold .1 Gm. with hot distilled water 10 Ml. (Cc.), filtrate + few drops of ammonia water—deep red. 2. Macerate .1 Gm. with 10 drops of alcohol, boil with distilled water 10 Ml. (Cc.), cool, filter, shake filtrate with ether 10 Ml. (Cc.); shake 3 Ml. (Cc.) of the yellow, separated ethereal solution with 3 Ml. (Cc.) of ammonia water—ammoniacal solution + distilled water 20 Ml. (Cc.), remains cherry-red. *Solvent:* diluted alcohol. Dose, ʒss–1 (2–4 Gm.).

ADULTERATIONS.—Barks of allied species, especially *R. carniol'ica,* the bark of which is thicker, grayish, longitudinally wrinkled, numerous lenticels, but smaller, obscured and less prominent, bitter, astringent, medullary rays 4–7 cells wide.

Commercial.—Obtain bark in the spring from young trunks and large branches, dry carefully; should not be taken from old trunks, as that has different taste and characteristics. The emetic action of green bark is due to a hydrolytic ferment, which is destroyed either by aging or moderately heating (38° C.; 100° F. for 48 hours). Owing to its various European names—black alder, aune noir, schwarzerle, etc.—it is likely to be confused with the genus *Alnus,* to which more properly such names belong.

CONSTITUENTS.—Frangulin (rhamnoxanthin) .04 p. c., Emodin 1–3.8 p. c., Isoemodin, frangulic acid, chrysophan, resin, tannin, ash 5–6 p. c.

Frangulin, $C_{21}H_{20}O_9$.—Glucoside, obtained by macerating bark 4 days in carbon disulphide; evaporate, exhaust residue with alcohol, leaving fat behind, evaporate alcoholic solution to dryness, crystallize from ether. It is in yellow crystals, sublimable, insoluble in water, slightly soluble in cold alcohol and ether, soluble in hot fixed oils, hot alcohol, benzin, turpentine, purple by alkalies; dyes cotton, silk, wool, etc., yellow; with hydrochloric acid yields glucose and frangulic (frangulinic) acid, by hydrolysis yields emodin and rhamnose, $C_6H_{12}O_5$, while emodin + rhamnose = frangulin + water; thus, (1) $C_{21}H_{20}O_9 + H_2O = C_{15}H_{10}O_5 + C_6H_{12}O_5$, or (2) $C_{15}H_{10}O_5 + C_6H_{12}O_5 = C_{21}H_{20}O_9 + H_2O$.

Emodin (Frangula-emodin), $C_{15}H_{10}O_5$.—In reddish-orange crystals, considered to be trioxymethylanthraquinone; also found in aloes, cascara sagrada, rhubarb, senna, etc.

Isoemodin, $C_{15}H_8O_4$.—Bitter and laxative; fresh bark yields neither frangulin nor emodin, as these develop by age.

Frangulic (Frangulinic) Acid, $C_{14}H_8O_4$.—Glucoside, obtained by boiling alcoholic solution of frangulin with hydrochloric acid; yellowish-brown crystals, aperient like cathartic acid.

PREPARATIONS.—1. *Fluidextractum Frangulæ.* Fluidextract of Frangula. (Syn., Fldext. Frangul., Fluid Extract of Frangula, Fluidextract of Buckthorn Bark; Extractum Rhamni Frangulæ Liquidum; Fr. Extrait fluide de Bourdaine; Ger. Faulbaumrindenfluidextrakt.)

Manufacture: Similar to Fluidextractum Tritici, page 91; evaporate to 75 Ml. (Cc.), cool, add alcohol 25 Ml. (Cc.), and, if necessary, water q. s. 100 Ml. (Cc.). Dose, ʒss–1 (2–4 Ml. (Cc.)).

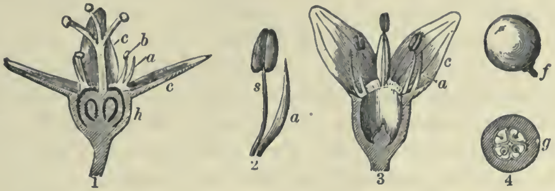


Fig. 251.—*Rhamnus cathartica: 1–3,* the imperfect pistillate and staminate flowers; *2,* stamens—*s,* fertile, *a,* sterile; *4, f,* fruit; *g,* cross-section of fruit.

Unoff. Preps.: Decoction, 5 p. c., dose, ℥ss–1 (15–30 Ml. (Cc.)). *Extract,* dose, gr. 2–8 (.13–.5 Gm.). *Ointment. Elixir Catharticum Compositum,* fldext. 12.5 p. c., fldext. senna 10, fldext. rhubarb 6.2, +.

Properties.—Purgative, tonic, diuretic. When fresh, emetic, severe intestinal irritant, causing much pain, but when modified by age resembles rhubarb or senna, though milder.

Uses.—In dropsy, costiveness, constipation of pregnancy (fluidextract, ♏xx (1.3 Ml. (Cc.)) ter die). Ointment of fresh bark for parasitic skin affections (itch, etc.).

Allied Plants:

1. *Rhamnus cathar'tica, Buckthorn.*—The nearly ripe fruit (berries), official 1820–1840, Europe, N. Asia, naturalized in N. America. Small tree, 3–4.5 M. (10–15°) high, short branches, thorny; leaves 2.5–5 Cm. (1–2′) long, 2.5 Cm. (1′) wide; flowers greenish; fruit Sept., black berries, size of a pea, green juice, 3–4–seeded; taste bitter, acrid; contains emodin-autranol, gesterin, rhamno-cathartin (a glucoside of emodin)—emodin, rhamnonigrin, resin (containing emodin), rhamnose, glucose, fixed oil, quercetin and rhamnin (yellow coloring matter). Used as a cathartic. Dose, ʒss–1 (2–4 Gm.); decoction, fluidextract (dil. alc.), syrup, 20 p. c. (fldext.), expressed juice made into syrup. Fresh juice with alum or lime yields the pigment *sap green. R. carolinia'na, Carolina (Southern) Buckthorn,* New York to Texas. Shrub or small tree; leaves oblong, serrate; flowers short-peduncled; fruit purple, 3-seeded.

CASCARA SAGRADA. CASCARA SAGRADA.

Rhamnus Purshiana, *De Candolle.* } The dried bark of the trunk and branches.

Habitat. N. Idaho, west to the Pacific (N. California).

Syn. Casc. Sagr., Rhamnus Purshiana, U. S. P., 1900, Chittem Bark, Sacred-, Persian-, Persiana or Purchiana Bark, Bearberry, Bear (Shittim) Wood; Rhamni Purshiani Cortex.

Pur-shi-a'na. L. of Pursh, after Frederick Pursh (L. *Purshia*), author of *Flora Americæ Septentrionalis,* 1817.

Cas'ca-ra Sa-gra'da. L. Sp. *cascara,* bark, + *sagrada,* sacred—holy bark—*i. e.,* so considered by many natives, on account of its medicinal properties.

PLANT.—Small tree, 4.5–6 M. (15–20°) high; twigs pubescent; leaves 5–15 Cm. (2–6′) long, 2.5–7.5 Cm. (1–3′) wide, thin, elliptic, apex obtuse, base rounded, pubescent beneath, dull green, dentate, petioles short, downy; flowers large, umbellate cymes; fruit drupe, black, obovoid, 8 Mm. ($\frac{1}{3}$′) long, 3-lobed, 3-seeded. BARK, in quills, flattened or transversely curved pieces, 2.5–10 Cm. (1–4′) long, 1–5 Mm. ($\frac{1}{25}$–$\frac{1}{5}$′) thick, brownish, longitudinally ridged, often nearly covered with grayish, whitish lichens, bearing small blackish apothecia, sometimes numerous lenticels, occasionally mosses; inner surface yellowish-brown, striate, red when moistened with solutions of alkalies; fracture short, inner bark with projections of bast-fibres and medullary rays forming converging groups, outer bark with groups of stone cells, more apparent on moistening fresh surface with phloroglucinol T. S. and hydrochloric acid; odor distinct; taste disagreeable, bitter, slightly acrid. POWDER, light brown; microscopically—elongated groups of bast-fibres, crystal fibres, stone cells, fragments of parenchyma and medullary ray cells (red with alkalies), starch grains, .003–.008 Mm. ($\frac{1}{8325}$–$\frac{1}{3125}$′) broad, rosette aggregates of calcium oxalate, fragments of brownish cork. *Tests:* 1. Shake .1 Gm. + hot water (10) occasionally until cold, filtrate + ammonia water (10)—orange-yellow. 2. Macerate .1 Gm. + few drops of alcohol, boil with 10 Ml. (Cc.) of water, cool, filter, shake with 10 Ml. (Cc.) of ether—yellow ethereal solution separates; of this shake 3 Ml. (Cc.) + 3 Ml. (Cc.) of ammonia water

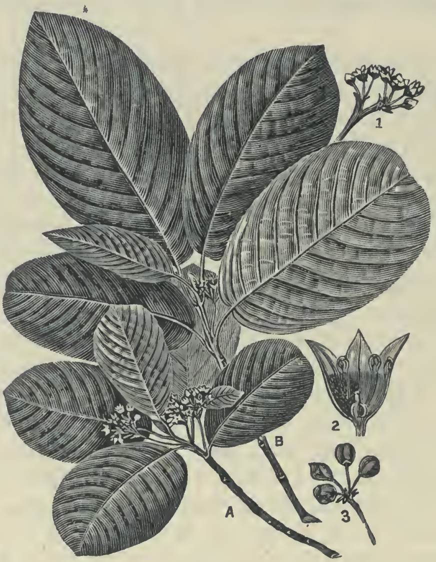


FIG. 252.—*Rhamnus Purshiana* (Cascara Sagrada): *A*, *B*, flowering branches: *1*, flower cluster; *2*, flower, vertical section, magnified; *3*, fruit.

—separated ammoniacal solution + 20 Ml. (Cc.) of water remains yellowish-red. *Solvent:* diluted alcohol. Dose, gr. 15–60 (1–4 Gm.).

ADULTERATIONS.—Barks of allied species: Formerly the smaller quills of *R. californica*, with medullary rays irregularly curved and grouped; in powder often find *R. Frangula*, which, owing to absence of stone cells and its longer bast-fibres, may be recognized; to this latter ammonia imparts deeper color.

CONSTITUENTS.—Emodin (non-laxative), isoemodin, resin, tannin 2 p. c., glucose, volatile oil (yellowish-green, odorous), fixed oil (rhamnol arachidate, glycerides of linolic and myristic acids) 2 p. c., rhamnol (alcohol identical with quebrachol), $C_{20}H_{34}O$, hydrolytic ferment (non-griping), syringic acid (not preëxisting in the bark, but from a substance of unknown nature by the action of acids), ash 6–8 p. c. The active principle, undetermined chemically, but possibly a glucosidal derivative, is obtained by precipitating aqueous solution of the alcoholic extract with lead subacetate, treating precipitate with ethyl-acetate, thereby yielding a non-crystalline, sticky mass containing laxative constituent. The "cascarin" and "purshianin" of previous investigators are regarded now simply as emodin with impurities, these latter constituting the medicinal entity, as purshianin gr. $\frac{1}{5}$ (.013 Gm.) is purgative. The constituents of fresh (1-year) and matured (3-year) bark seem not to differ.

PREPARATIONS.—1. *Extractum Cascaræ Sagradæ.* Extract of Cascara Sagrada. (Syn., Ext. Casc(ar). Sagr., Extractum Rhamni Purshianæ, U. S. P. 1900, Powdered Extract of Cascara Sagrada; Br. Extractum Cascaræ Sagradæ Siccum; Fr. Extrait de Cascara Sagrada; Ger. Amerikanisch Faulbaumrindenextrakt.)

Manufacture: Macerate 3 hours 90 Gm. with boiling water 400 Ml. (Cc.), percolate until exhausted (500 Ml. (Cc.)), evaporate to dryness, pulverize, add magnesium oxide 2.5 Gm. and dried starch q. s. 30 Gm.; mix thoroughly, pass through fine sieve. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. 2–8 (.13–.5 Gm.).

2. *Fluidextractum Cascaræ Sagradæ.* Fluidextract of Cascara Sagrada. (Syn., Fldext. Cascar. Sagr., Extractum Rhamni Purshianæ Fluidum; Br. Extractum Cascaræ Sagradæ Liquidum; Fr. Extrait fluide de Cascara Sagrada; Ger. Cascara Sagradafluidextrakt.)

Manufacture: Similar to Fluidextractum Tritici, page 91; concentrate aqueous percolate to 75 Ml. (Cc.), cool, add alcohol 25 Ml. (Cc.), and, if necessary, water q. s. 100 Ml. (Cc.). Dose, ♏x–30 (.6–2 Ml. (Cc.)).

3. *Fluidextractum Cascaræ Sagradæ Aromaticum.* Aromatic Fluidextract of Cascara Sagrada. (Syn., Fldext. Cascar. Sagr. Arom., Tasteless Fluidextract of Cascara Sagrada; Fr. Extrait fluide aromatique de Cascara Sagrada; Ger. Bitterloses Cascara Sagradafluidextrakt.)

Manufacture: Moisten 100 Gm., + magnesium oxide 12.5 Gm. with boiling water 200 Ml. (Cc.), macerate for 2 hours, pack, percolate with boiling water until exhausted, evaporate to 50 Ml. (Cc.), while warm dissolve in it pure extract of glycyrrhiza 4 Gm., cool, add glycerin 20 Ml. (Cc.), alcohol 25 Ml. (Cc.) having dissolved in it benzosulphinide .1 Gm., oil of anise .25 Ml. (Cc.), oil of cassia. 02 Ml. (Cc.), oil of coriander .01 Ml. (Cc.), and methyl salicylate .02 Ml. (Cc.), add boiling water q. s. 100 Ml. (Cc.). Dose, ♏x–30 (.6–2 Ml. (Cc.)).

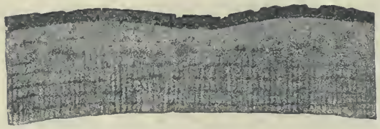


FIG. 253.—*Rhamnus Purshiana:* transverse section, magnified 10 diam.

Unoff. Preps.: Fluidglycerate, 100 p. c., dose, ♏xv–30 (1–2 Ml. (Cc.)). *Aromatic Fluidglycerate,* 75 p. c.+ fluidglycerate of glycyrrhiza 25, dose, ♏xv–30 (1–2 Ml. (Cc.)). *Elixir,* 50 p. c., + aromatic elixir 50. *Compound Elixir,* 12.5 p. c. (arom. fldextr.), + fldextr. of senna 7.5, fldextr. of juglans 6.5, aromatic elixir q. s. 100. *Cordial,* dose, ʒj–2 (4–8 Ml. (Cc.)). *Syrupus Cascaræ Aromaticus* (Br.), 40 p. c., dose, ʒss–2 (2–8 Ml. (Cc.)). *Tincture,* 15 p. c., dose, ʒss–2 (2–8 Ml. (Cc.)).

PROPERTIES.—Purgative, tonic, febrifuge, increases secretions of stomach, liver, pancreas; not usually given as a single cathartic, but where frequent repetition is required; it operates in 6–10 hours, and wears well, as generally increased quantities are not needed when habitually used; it regulates action of the bowels, and acts best when given on empty stomach in concentrated form. Fresh bark gripes, owing to a ferment which in time changes, so that matured official bark and its preparations should be without this property. The purgative action is claimed by some to be due largely to resins, tonic to bitter principle.

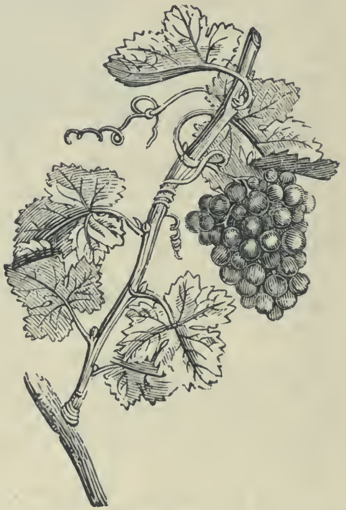


FIG. 254.—*Vitis vinifera:* in fruit.

USES.—Habitual constipation due to torpor of the colon, dyspepsia, hemorrhoids.

Allied Plants:

1. *Rhamnus califor'nica.* — California, Mexico. Plant, also called locally "cascara sagrada," is smaller than *R. Purshiana,* and has bark thinner, with reddish dull gray color; leaves elliptical, dentate; flowers numerous, abortive; fruit purple, 3-seeded.

2. *Vi'tis vinif'era, Grape Vine.* —Vitaceæ. The fermented juice (white wine, red wine) of fresh fruit, official 1820–1910; W. Asia, cult. universally. Perennial shrub; stem woody, brownish, long, tortuous; leaves 5–10 Cm. (2–4′) long, 5-lobed, roundish, cordate; flowers greenish; fruit ovoid berry, 12–25 Mm. (½–1′) broad, pericarp thin, green, yellow, purple, red, pulp juicy, greenish, sweet, acidulous;

seeds few, pyriform; grapes contain sugar 12–30 p. c., potassium bitartrate, calcium tartrate, calcium phosphate, potassium sulphate, sodium chloride, tannic acid, malic acid, albumin, pectin, etc.; argol—potassium bitartrate, tartaric acid. 1. Vinum Album, White Wine. Obtained by fermenting for several weeks the juice of fresh grapes freed from seeds, stems, skins; contains 7–12 (8.5–15 vol.) p. c. of alcohol, and includes Sherry, Lisbon, Teneriffe, Madeira, Rhenish, Hock, Moselle, French, California, etc. 2. Vinum Rubrum, Red Wine. Obtained by fermenting juice of fresh grapes in the presence of their skins; contains 7–12 (8.5–15 vol.) p. c. of alcohol, and includes Claret, Port, Burgundy, etc. Stimulant, depressant, astringent, tonic, diaphoretic; fevers, general debility, irritable stomach, ulceration, gangrene, tetanus, old age.

46. MALVACEÆ. Mallow Family.

Mal-va'se-e. L. *Malv-a* + aceæ, fem. pl. of *malvaceus*, of mallows; *malva*, mallow, fr. Gr. μαλακός, soft, mild—*i. e.*, owing to its emollient properties or soft, downy leaves. Herbs, shrubs, trees. Distinguished by stamens monadelphous, anthers 1-celled, seed reniform; flowers regular; sepals 5; petals 5; pistils several, united; albuminous, superior; temperate climate, tropics; demulcent, tough fibres, hairs as cotton.

Genera: **1. Althæa. 2. Gossypium.**

ALTHÆA. ALTHÆA.

Althæa officinalis, *Linné.*	The root deprived of brown, corky layer and small roots, and carefully dried.

Habitat. Europe, Western and Northern Asia; naturalized in salt marshes, New England, New York, Australia; cultivated in Europe.

Syn. Marsh Mallow Root, Marsh Mallow, White Mallow, Mortification Root, Sweetweed, Wymote; Fr. Racine de Guimauve, Guimauve; Ger. Radix Althæa, Eibischwurzel, Eibisch.

Al-thæ'a. L. fr. Gr. ἀλθαίνω, to heal, cure—*i. e.*, its medicinal qualities (Dioscorides).

Of-fi-ci-na'lis. L. see (*Asagræa*) *officinalis*, page 102.

Plant.—Perennial herb .6–1.3 M. (2–4°) high, having several woolly stems; leaves 2.5–7.5 Cm. (1–3′) long, serrate, both sides pubescent; flowers large, 2.5–5 Cm. (1–2′) in diameter, purple. Root, slenderly tapering, 15–30 Cm. (6–12′) long, 1–2 Cm. ($\frac{2}{5}$–$\frac{4}{5}$′) thick; usually cut into small pieces, 5 Mm. ($\frac{1}{5}$′) thick, whitish, longitudinally furrowed, frequently spirally twisted and covered with somewhat loosened bast-fibres (hairy); fracture fibrous (bark), short, granular (wood); internally yellowish-white; bark 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, porous (due to mucilage cells) and separated from slightly radiating wood by grayish cambium zone; odor slight; taste sweetish, mucilaginous. Powder, whitish; microscopically—many starch grains, .003–.02 Mm. ($\frac{1}{8325}$–$\frac{1}{1250}$′) broad; sclerenchymatous fibres in groups;

tracheæ, few calcium oxalate rosette aggregates. *Tests:* 1. Macerate 1 Gm. in water 10 Ml. (Cc.) 30 minutes, stir occasionally, filter—pale yellow neutral mucilage, turning deep yellow with a few drops of potassium hydroxide T. S.; mucilage should not have a sour or ammoniacal odor. Should be kept in tightly-closed containers, adding occasionally a few drops of chloroform or carbon tetrachloride to prevent insect attack. *Solvents:* water (cold), dissolving asparagin, mucilage, sugar, (hot), also starch. Dose, ʒss–1 (2–4 Gm.).

ADULTERATIONS.—ROOT: Belladonna root, when young and peeled, resembles althæa, but distinguished by absence of hair-like bast-fibres, and by possessing visible yellowish wood bundles; old dark-colored althæa roots sometimes are whitened with calcium oxide or sulphate, which subside to the bottom upon soaking in water, thereby readily being detected; root sometimes marketed cut in small cubes, rendering admixtures more likely; POWDER: Starchy substances recognized by shape of starch granules.

Commercial.—Plant during first 2 years produces only a tap-root, which soon thereafter becomes tough, woody, inert, and much branched, the branches having little medicinal value; the unscraped root is yellowish-brown, non-fibrous, and should be collected from cultivated plants, peeled, and dried carefully; leaves and flowers sometimes used.

CONSTITUENTS. — Asparagin (althein, amido-succinamic acid, asparamide) 1–2 p. c., Mucilage (bassorin, althæa mucilage, upon which value depends) 35 p. c., Starch 37 p. c., pectin 11 p. c., betaine, sugar 11 p. c., fat 1.25 p. c., ash 4–8 p. c.

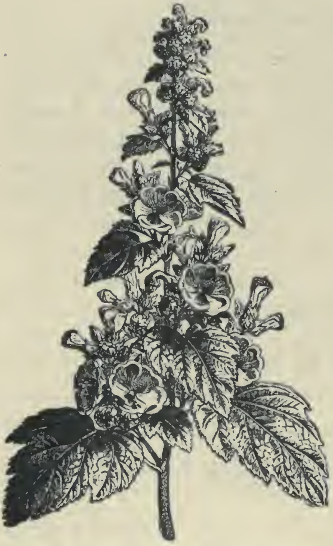


FIG. 255.—*Althæa officinalis.*

Asparagin, $C_4H_8N_2O_3 + H_2O$.—Obtained by putting the thick, viscid mucilage of althæa into a dialyzer, with water outside; asparagin passes into the water, which upon evaporation yields the crystals. These are colorless, neutral, transparent, lustrous, sp. gr. 1.520, soluble in water (47), acids, alkalies, converted by these latter into ammonia and organic acid; therapeutically inactive. Dose, gr. 5–10 (.3–.6 Gm.).

PREPARATIONS.—1. *Massa Hydrargyri,* 15 p. c. 2. *Pilulæ Ferri Carbonatis,* $\frac{1}{6}$ gr. (.01 Gm.). 3. *Pilulæ Phosphori,* 1 gr. (.06 Gm.).

Unoff. Preps.: Syrup, 5 p. c., dose, ʒj–4 (4–15 Ml. (Cc.)). *Decoction,* 5 p. c. *Ointment. Poultice. Species Althæa* (*Emollientes, Pectorales*).

PROPERTIES.—Demulcent, emollient, protective.

Uses.—Inflammations of pulmonary, digestive, and urinary organs, mucous membranes; skin eruptions, herpes, psoriasis, enema (decoction) for vaginal and rectal irritation. In pharmacy, the powdered root being very absorbent, is used to harden pills, troches, electuaries, etc.

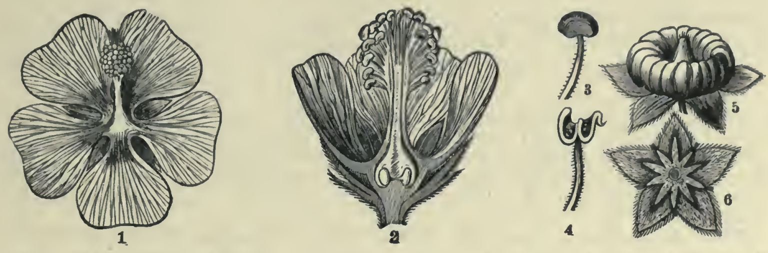


Fig. 256.—*Althæa officinalis:* *1*, expanded flower; *2*, vertical section of flower; *3*, stamen; *4*, stamen after discharge of pollen; *5*, fruit; *6*, outside calyx as seen from beneath.

The dried leaves (althæa folia) also used medicinally.

Allied Plants:

1. *Althæa ro′sea, Hollyhock.*—Levant. Petals used; formerly cultivated in gardens. Flowers (*Flores Malvæ Arboreæ*) 7.5–12.5 Cm. (3–5′) broad, nearly sessile, composed of a tomentose calyx and 5 purple petals.

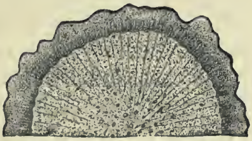


Fig. 257.—Althæa: transverse section, magnified 2 diam.

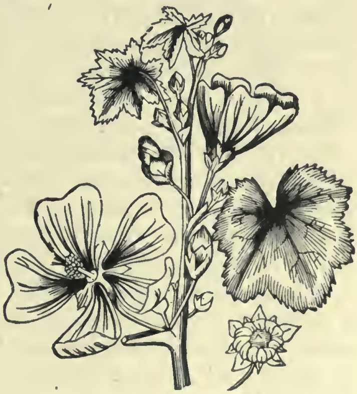


Fig. 258.—*Malva sylvestris:* showing flowers, leaves, and fruit.

2. *Mal′va sylves′tris, High Mallow, M. vulga′ris, Common Mallow,* and *M. rotundifo′lia, Low* (*Running*) *Mallow.*—The flowers are rose-red, purple, or whitish, but when dried bluish, green with ammonia, red with acids, slight odor; sweetish, mucilaginous taste.

3. *Abu′tilon* and *Hibis′cus* species have similar medicinal properties, and may be used satisfactorily one for the other.

GOSSYPIUM. COTTON.

1. Gossypium Purificatum. Purified Cotton.
2. Oleum Gossypii Seminis. Cottonseed oil.

Gossypium herbaceum, *Linné:* one or more cultivated varieties. — 1. The hairs of the seed, freed from adhering impurities and linters, and deprived of fatty matter. 2. The fixed oil from the seeds.

Habitat. C. Asia, India, China, Arabia, N. E. Africa, Egypt; cultivated in United States, W. Indies, C. and S. America, N. Africa, Australia, Spain.

Syn. 1. Gossyp. Purif., Absorbent Cotton, Gossypium, Cotton, Cotton Wool; Fr. Coton; Ger. Gossypium depuratum, Gereinigte Baumwolle. 2. Ol. Gossyp. Sem., Cotton Seed Oil; Fr. Huile (de Coton) de Semences de Cotonnier; Ger. Baumwollsamenöl.

Gos-syp′i-um. L. fr. Ar. *Goz, Gothn,* a soft, silky substance—*i. e.,* the hairs of the seeds.

Her-ba′ce-um. L. *herbaceus,* grassy, herby—*i. e.,* the plant habit.

Plant.—Small biennial or triennial shrub; stem branching, 1.5–3 M. (5–10°) high, more or less woody; leaves hoary, palmately 3–5-lobed; flowers large, 5–7.5 Cm. (2–3′) long and wide, yellow, purple spot near the claw; fruit capsule or boll 4–5 Cm. ($1\frac{3}{5}$–2′) long, 3–5-celled, opening by as many valves when ripe, revealing loose, white tuft of long, slender hair that surrounds each one of the numerous seeds. Hairs of the Seed, in white, soft, fine filaments, 12–37.5 Mm. ($\frac{1}{2}$–$1\frac{1}{2}$′) long; under microscope hollow, flattened, twisted bands, spirally striate, slightly thickened edges; inodorous; almost tasteless; insoluble in ordinary solvents. *Tests:* 1. Compress in the hand, throw upon cold water—readily absorbs latter and sinks. 2. Incinerate 5 Gm.—ash .2 p. c. *Impurities:* Alkali, acid, resins, soap, fatty matter. *Solvent:* Ammonia solution of cupric oxide. Oil of the Seeds, a pale yellow, oily liquid, odorless, nearly odorless, bland taste, slightly soluble in alcohol; miscible with ether, chloroform, petroleum benzin, carbon disulphide, sp. gr. 0.920; on cooling below 12° C. (54° F.) particles of solid fat separate, and at —2° C. (28° F.) nearly or quite a solid. *Tests:* 1. With sulphuric acid, preferably diluted with carbon disulphide —reddish-brown color at once. 2. Mix 2 Ml. (Cc.) with 2 Ml. (Cc.) of a mixture of equal vols. of amyl alcohol and a 1 p. c. solution of sulphur in carbon disulphide, and immerse in boiling saturated solution of sodium chloride—red color in 10–15 minutes. Dose, ʒij–8 (8–30 Ml. (Cc.)).

Substitutions.—I. Hairs: *Bœhme′ria ni′vea,* fibre may be used for cotton, lint, etc. II. Oil: 1, Brazil or Para Nut Oil; nuts 2.5–5 Cm. (1–2′) long, 3-edged, brownish-gray kernel, white, almond taste; yield 60 p. c. oil; 2, Oleum Fagi, Beech Oil, from fruit of *Fa′gus sylvat′ica,* kernels yield 22 p. c. oil; yellow, sp. gr. 0.922, congeals at —17.5° C. (0° F.).

Commercial.—Cotton was known to the Arabians, Egyptians, and Chinese in the 10th century, and was carried to Spain by the Moors in the 16th century. The ancient Egyptians possibly were unacquainted with it, as their mummy fibres are all linen, and no seeds or paintings of plants are found in the tombs. However, in Peru mummy clothing from earliest date contain cotton, consequently here may be its original habitat. Many species now give similar products, but our own is thought to be from *G. barbadense*, Barbadoes Island, W. Indies. Chapman refers long-staple or Sea Island cotton, which we cultivate, to *G. ni'grum*, and short-staple or Upland cotton to *G. al'bum*. The hairs are removed by hand or mill (cotton gin) from the seeds, and owing to the latter containing fixed oil, 15–20 p. c., a portion of it becomes absorbed by the attached fibre and must be eliminated before adapted for general use. Purification is effected by boiling carded cotton in 5 p. c. solution of potassium or sodium hydroxide, washing with water to remove soap, expressing, adding 5 p. c. solution of chlorinated lime, allowing to stand half an hour, washing, expressing, adding acidulated (HCl 5 p. c.) water, washing, expressing—a process that may be repeated if necessary, removing 7–10 p. c. of weight, chiefly fat. The oil is obtained by cracking off testa, grinding and expressing kernels; at first it is thick, reddish-brown, turbid from albumin and mucilage, which mostly subside on standing, yielding orange-colored *clarified oil;* when this is treated with boiling water or superheated steam albuminoids are coagulated, giving lighter-colored *refined oil,* which upon being bleached (agitated with alkaline solution and heated) yields *winter-bleached oil;* the loss in refining is 5–10 p. c., and as such is official. It is exported extensively for olive oil adulteration, for which demand a line of tanked steamers ply regularly between New Orleans and Europe, each having a capacity of 500,000–1,000,000 gallons; 12,000–20,000 barrels (1894–3788 Kl.).

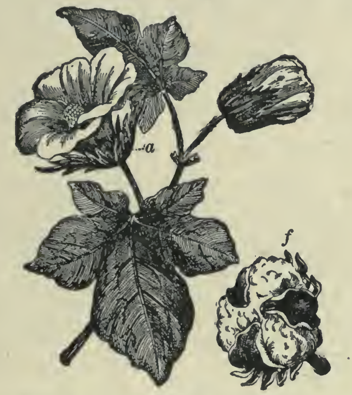


Fig. 259.—*Gossypium herbaceum: a,* outside calyx; *f,* fruit.

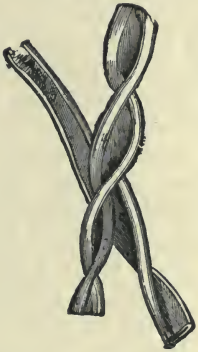


Fig. 260. — *Gossypium herbaceum:* cotton fibre, magnified 250 diam.

Constituents.—I. Hairs: Cellulose, inorganics 1.5 p. c., fixed oil 7–10 p. c. II. Oil: Olein, palmitin, linolein, glyceride of linoleic acid, and non-saponifiable yellow coloring matter.

Preparations.—I. Hairs: 1. *Pyroxylinum.* Pyroxylin. (Syn., Pyroxylin, Soluble Gun Cotton, Colloxylin, Collodion Cotton, Lana Collodii; Fr. Fulmicoton soluble; Ger. Kollodiumwolle.)

Manufacture: Macerate purified cotton in a cooled mixture of 14 vols. of nitric acid and 22 vols. of sulphuric acid until the cotton is soluble in a mixture of 1 vol. of alcohol and 3 vols. of ether, remove adhering acid by washing first with cold, then boiling water, dry in small portions at 60° C. (140° F.). It is a yellowish-white matted mass of filaments, resembling raw cotton in appearance, harsh to the touch, exceedingly inflammable, burning, when unconfined, very rapidly with luminous flame, less explosive than cellulose hexanitrate; kept in well-closed bottles exposed to light; decomposes with evolution of nitrous vapors, and carbonaceous residue; consists chiefly of cellulose tetranitrate, $C_{12}H_{16}(ONO_2)_4O_6$. *Tests:* 1. Soluble slowly but completely in 25 parts of a mixture of 1 vol. of alcohol and 3 vols. of ether; soluble in acetone, glacial acetic acid, and precipitated from these solutions on the addition of water. 2. Saturate .5 Gm. with alcohol in a dish in cold water, ignite from top; when combustion complete, heat dish to redness—ash .3 p. c. *Impurities:* Soluble substances. Should be kept dark, dry, in cartons packed loosely.

Prep.: 1. *Collodium.* Collodion. (Syn., Collod.; Fr. Collodion; Ger. Collodium, Kollodium.)

Manufacture: Add alcohol 25 Ml. (Cc.) to pyroxylin 4 Gm., shake, add ether 75 Ml. (Cc.), shake until dissolved; cork well, set aside until clear, decant from any sediment. It is a clear, slightly opalescent, syrupy liquid; colorless, slightly yellowish; odor of ether; highly inflammable, and when exposed in thin layer leaves a transparent, tenacious film; sp. gr. 0.770; mixed with equal volume of distilled water a viscid, stringy mass separates; aqueous liquid not acid. Should be kept cool, remote from fire, in well-closed containers.

Prep.: 1. *Collodium Flexile.* Flexible Collodion. (Syn., Collod. Flex.; Fr. Collodion élastique; Ger. Collodium elasticum, Elastisches Kollodium.)

Manufacture: Shake in a tared bottle collodion 95 Gm., castor oil 3 Gm., camphor 2 Gm., until latter dissolved. Should be kept cool, remote from fire, in well-closed containers.

Prep.: 1. *Collodium Cantharidatum.* Cantharidal Collodion. (Syn., Collod. Canth., Blistering Collodion, Vesicating Collodion; Br. Collodium Vesicans; Fr. Collodion (vesicant) cantharide—cantharidal; Ger. Spanischfliegen Kollodium.)

Manufacture: Macerate, for 24 hours in covered container, cantharides 60 Gm., acetone 55 Ml. (Cc.), glacial acetic acid 5 Ml. (Cc.); percolate with acetone until exhausted; distil percolate down to 15 Gm., which, when cold, dissolve in flexible collodion 85 Gm., let stand until clear, decant from any sediment. Should be kept cool, remote from fire, in well-closed containers.

II. OIL: 1. *Sapo Mollis.* Soft Soap. (Syn., Sapo Moll., Sapo Viridis, Green Soap; Fr. Savon(mou)vert; Ger. Sapo kalinus, Kaliseife, Grune seife.)

Manufacture: Heat until dissolved potassium hydroxide 86 Gm. in water 100 Ml. (Cc.), add cottonseed oil 430 Gm., stir, bring to boil (until froth appears), add alcohol 50 Ml. (Cc.), stir actively until froth suddenly rises, withdraw heat, stir until paste, and if saponification be complete (otherwise add more potassium hydroxide or cottonseed oil and heat until it is so), add water q. s. 1000 Gm., warm gently, stirring carefully, until water all absorbed and clear soap results. It is a soft, unctuous, yellowish-white, brownish-yellow mass, slight characteristic odor, alkaline taste; aqueous solution alkaline; solution in hot distilled water (1 in 20) nearly clear.

Prep.: 1. *Linimentum Saponis Mollis.* Liniment of Soft Soap. (Syn., Lin. Sapon. Moll., Tincture of Green Soap, Spiritus Saponis Kalinus Hebra; Fr. Teinture de Savon vert; Ger. Hebra's Seifenspiritus.)

Manufacture: 65 p. c. Mix oil of lavender 2 Ml. (Cc.) with alcohol 30 Ml. (Cc.), add soft soap 65 Gm., stir or agitate until dissolved, set aside 24 hours, filter, add alcohol q. s. 100 Ml. (Cc.); used externally.

2. *Linimentum Camphoræ*, 80 p. c.

Unoff. Preps.: I. HAIRS: *Gossypium Stypticum*—macerate 100 Gm. for 1 hour in solution of ferric chloride 80 Ml. (Cc.), glycerin 16, water 225, press until it weighs 300 Gm., dry, keep in well-closed containers. *Medicated Cottons* (salicylated, borated, benzoinated, chlorinated, phenolated (carbolated), iodoform, mercuric (bi)chloride, hæmostatic, etc.). *Collodium Stypticum* (dissolve tannic acid 20 Gm. in flexible collodion 80 Gm.; *Iodine Collodion*, 5 p. c.; *Iodoform Collodion*, 5 p. c.; *Compound Salicylic Collodion*, salicylic acid 11 Gm., fldext. of cannabis 10, flexible collodion q. s. 100; *Croton Oil Collodion*, 10 p. c.). II. SEED: *Cottonseed Tea* (mucilaginous drink for dysentery, diarrhœa, etc.).

PROPERTIES.—I. HAIRS: Protective. II. OIL: Demulcent, nutrient.

USES.—I. HAIRS: Dressing in burns, scalds, erysipelas, blisters, surgical wounds; prevents entrance of organic germs that cause suppuration and septic disease. Cotton batting maintains local heat in pneumonia, rheumatism, and may be made into pessaries. II. OIL: Like olive and almond oils in pharmacy, liniments, etc.; in culinary use for lard; to adulterate olive oil, in preparing woollen cloth, morocco leather, lubricating machinery, etc.

Derivative Product:

1. *Gossypii* (*Radicis*) *Cortex, Cotton Root Bark*, official 1860–1910.—It is in thin, flexible bands, quills, bark .2–1 Mm. ($\frac{1}{125}$–$\frac{1}{25}$′) thick, yellowish-brown, wrinkled, small lenticels, periderm often exfoliated, fuzzy (detached bast-fibres), inner surface whitish, striate, fracture tough; odor faint; taste slightly astringent, acrid; solvents: diluted alcohol, boiling water; contains resin (acid, colorless, soluble in water, becoming red on exposure and insoluble) 8 p. c., fixed oil, tannin, starch.

Emmenagogue, oxytocic, uterine hæmostatic, similar to ergot but less certain; dysmenorrhœa, amenorrhœa, uterine tumors and hemorrhages, popular among negroes (who brought it from Africa) in Southern States for inducing abortion. Dose, ʒss–1 (2–4 Gm.); decoction, ℥iv (120 Gm.) + Oij (900 Ml. (Cc.)), evaporated to Oj (450 Ml. (Cc.)), ℥ij (60 Ml. (Cc.)), every half-hour. fluidextract (alcohol, or alcohol 75 p. c. + glycerin 25 p. c.), ʒss–1 (2–4 Ml. (Cc.)).

Allied Plants:

1. *Gossypium barbaden'se, G. arbo'reum, G. religio'sum* (fibres yellow), etc.—These furnish products which may be used similarly to the official.

47. STERCULIACEÆ. Silk Cotton Family.

Ster-ku-li-a'se-e. L. *Sterculi-a* + aceæ, from *stercus*, excrement, *Sterculius*—God of—*i. e.*, named from the fetid flowers or fruit of certain species. Trees, shrubs. Distinguished from Malvaceæ by anthers 2-celled and flowers sometimes unisexual by abortion; calyx 5, corolla 5, twisted; tropics, temperate climates; demulcent, emetic, purgative.

Genus: **1. Theobroma.**

THEOBROMA. CACAO (CHOCOLATE TREE).

Oleum Theobromatis. Oil of Theobroma, *official.*

Theobroma Cacao, *Linné.* { A concrete, fixed oil obtained from the roasted seeds.

Habitat. S. America (Brazil), C. America, Mexico, W. Indies; cultivated in the tropics, largely in some of the W. Indies.

Syn. Semen (Fabæ) Cacao; Ol. Theobrom., Butter of Cacao, Cacao Butter, Oleum Theobromæ; Fr. Cacao, Fèves du Mexique, Beurre de Cacao; Oleum Cacao; Ger. Kakaobohnen; Kakaobutter.

Theo-o-bro'ma. L fr. Gr. θεός a god, + βρῶμα food, food of the gods—*i. e.*, its delicious qualities.

Ca-ca'o. L. Sp. from Mexican *kakahuati*—*i. e.*, its native name.

PLANT.—Handsome tree 9–12 M. (30–40°) high, round branches, bark gray, smooth; leaves 20–22.5 Cm. (8–9′) long, 6 Cm. (2⅖′) wide, lanceolate, acute, round base, entire, veins prominent beneath, petiole 2.5 Cm. (1′) long, thickened at both ends; young leaves pink; flowers pale pink, calyx and corolla 2.5 Cm. (1′) broad, alike in color; fruit large, 15–17.5 Cm. (6–7′) long, broadly fusiform, with 10 shallow furrows and blunt ridges, tuberculated, pendulous, single or 2–3 together, at first yellow, then red, purple, pericarp thick, tough, 5-celled; seeds many, closely packed in tiers, size of almonds, angular from pressure, immersed in copious, sweet buttery pulp, seed-coats 2, brownish.

CONSTITUENTS.—SEEDS: Fixed oil 50 p. c., starch 16 p. c., theobromine 1.5–4.5 p. c., caffeine, proteids 18 p. c., sugar .6 p. c., cacao-red 5–6 p. c., volatile odorous principle, ash 3.6–4.6 p. c.

Oleum Theobromatis. Oil of Theobroma.—This concrete, fixed oil is a yellowish-white solid (lighter-colored with age), faint, agreeable odor, bland, chocolate-like taste, usually brittle below 25° C. (77° F.), soluble in ether, chloroform, benzene, boiling dehydrated alcohol, slightly in alcohol, sp. gr. 0.973, melts at 30–35° C. (86–95° F.); contains stearin 40 p. c., palmitin, laurin, small amounts of glycerides of acetic, butyric, formic, linolic, and arachidic acids. *Test:* 1. Dissolve 1 Gm. in ether 3 Ml. (Cc.) in test-tube at 17° C. (63° F.), frequently immerse test-tube into ice-cold water—liquid not turbid nor with deposit of white flakes in less than 3 minutes, and after congealing should clarify at 15° C.; 59° F. (abs. of wax, stearin, tallow). Dose, ʒss–1 (2–4 Gm.).

ADULTERATIONS.—Wax, stearin, tallow, etc.

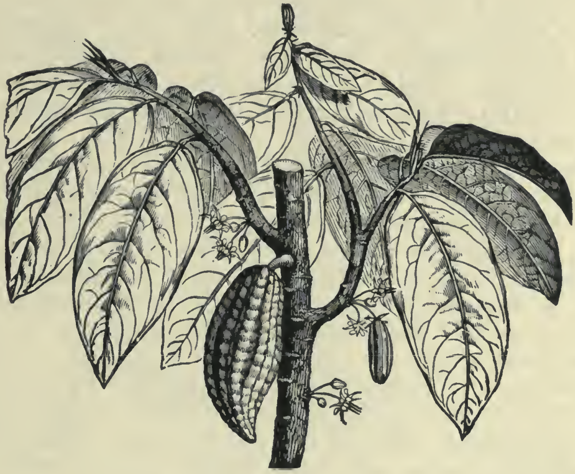


FIG. 261.—*Theobroma Cacao.*

Commercial.—The seeds when taken from the fruit and dried retain astringency and bitterness, properties which may be overcome by roasting, or sweating and fermenting in heaps for 1 week, or burying in a box for 3 days, then drying. The oil is extracted afterward by: 1, Expression; 2, Decoction; 3, Solution (benzin, carbon disulphide, chloroform, ether), the first process being considered best, and consisting in the removal of the shells, heating the kernels at 70° C. (158° F.), subjecting them to hydraulic pressure between hot iron plates or rollers, and running the oil into rectangular molds, where it soon congeals. The residual (dryish, oleaginous pulp) expressed cake or oil cake, still containing small amount of oil, is utilized as chocolate.

PREPARATIONS.—(Unoff.) *Emulsion. Ointments. Suppositories.*

PROPERTIES.—Nutrient, demulcent, emollient.

USES.—Seldom internally, only as suppositories, when it acts as an excipient or carrier for other medicine. Externally in cosmetic ointments, pill coating, abraded or inflamed surfaces.

Derivative Products:

1. **Theobrominæ Sodio-Salicylas. Theobromine Sodio-Salicylate,** $C_7H_7N_4O_2Na + C_6H_4(OH)COONa$, *official.*—(Syn., Theobrom. Sodio-Sal., Diuretin; Fr. Theobromine et Salicylate de Soude; Ger. Theobrominnatriumsalicylate.) Obtained by mixing aqueous solutions of equal molecules of sodium theobromine and sodium salicylate, evaporating to dryness. It is a white, odorless powder, sweetish, saline, somewhat alkaline taste, gradually absorbs carbon dioxide liberating theobromine, becoming partially insoluble in water; soluble in water (1), slightly in alcohol; contains, when dried to constant weight, theobromine 46.5 p. c., salicylic acid 38 p. c. *Tests:* 1. Ignited—residue produces intensely yellow flame and effervesces with acids. 2. Aqueous solution (1 in 20) colorless, clear, opalescent, strongly alkaline; aqueous solution (1 in 100), slightly acidulated with acetic acid, with ferric chloride T. S.—violet. *Impurities:* Caffeine, sodium carbonate, organic substances. Should be kept in well-closed containers. Dose, gr. 5–15 (.3–1 Gm.), 5–6 times daily, in dilute solution, capsule, wafer, followed by water.

PROPERTIES AND USES.—Diuretic, nervous stimulant; cardiac dropsy, nephritis (chronic, acute), dyspnœa, coughs; very slight action on heart and circulation; may produce headache, irregular pulse, vomiting, diarrhœa, gastric irritation (avoided by small doses and weak solutions); owing to greater solubility far superior to theobromine. *Incompatibles:* Acids, fruit syrups (decomposing and precipitating theobromine), bicarbonates, borates, phosphates, ferric salts, hydrated chloral, wines, etc.

2. *Theobromine* (dimethylxanthine), $C_7H_8N_4O_2$.—This is obtained by exhausting the kernels with hot water, straining, precipitating with lead acetate, filtering, removing lead with hydrogen sulphide, filtering, evaporating, and treating residue with hot alcohol, from which whitish, bitter crystals deposit. It is an alkaloid not altered by solution of potassium hydroxide, slightly soluble in water, alcohol, ether, forms salts (hydrochloride, nitrate, salicylate, etc.), and is related to caffeine, this latter being its methyl derivative—methyltheobromine, into which theobromine may be converted by treating theobromine silver with methyl iodide.

3. *Chocolate, Cacao Præparata, Cocoa.*—The expressed cake, preferably from the seeds (consisting originally of shells 12 p. c. and kernels 88 p. c.) deprived of testa, is reduced to a paste, then mixed with sugar, vanilla, cinnamon, annotto, etc., and molded into cakes, thus constituting commercial cacao, cocoa, chocolate (fr. indian *chocolat*). This is subject to much adulteration with starch, rice flour, barley flour, sassafras nuts, chestnuts, clove, butter, lard, cocoanut shells, etc.

Allied Plants:

1. *Co'la acumina'ta, Cola, Kola, Kola-nut.*—The recent or dried cotyledons, W. Africa, W. Indies; cultivated. Tree 15–20 M. (50–65°) high, smooth stem, leaves 15–20 Cm. (6–8′) long, lanceolate-ovate, acuminate, flowers, staminate and pistillate, yellowish, fruit yellowish-

brown, 5 segments, rough, woody, follicle 10–13 Cm. (4–5′) long, each segment 1–3-seeded; seed 3–4 Cm. ($1\frac{1}{5}$–$1\frac{3}{5}$′) long, 2–3 Cm. ($\frac{4}{5}$–$1\frac{1}{5}$′) thick and wide, oblong-ovate somewhat flattened or angular from mutual pressure, rounded on one side, and this irregularly infolded upon the other, brownish, mottled with blackish spots, yellowish-white inside, cotyledons of different size, thick, variously bent, odor nutmeg- or rose-like, taste aromatic, astringent; contains caffeine (kola-tannate) 2.7–3.6 p. c., theobromine, starch 34–42 p. c., tannin, kola-red, kolatin, volatile oil—kolanin is a mixture of kola-red and caffeine, kolatine (only in fresh nuts, which should not be used, action opposite to caffeine). Stimulant, tonic, nervine, diuretic, astringent, similar to coffee, but resembles coca in aiding the endurance of fatigue without food; neuralgia, headache, migraine, diarrhœa, indigestion, weak and irregular heart. Dose, gr. 15–30 (1–2 Gm.); elixir, 8 p. c., ʒj–3 (4–12 Ml. (Cc.)); fluidextract (67 p. c. alcohol); tincture, 15 p. c. (diluted alcohol), ʒj–2 (4–8 Ml. (Cc.)).

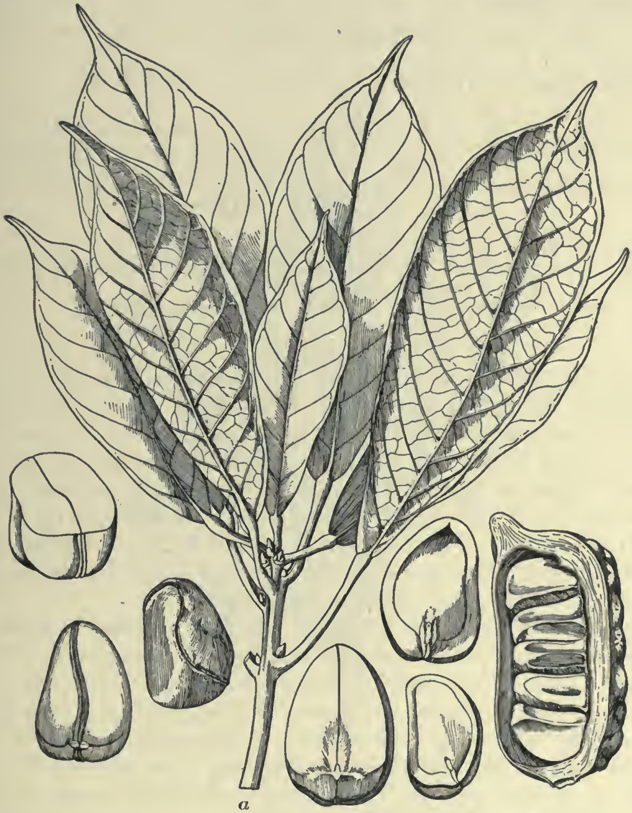


FIG. 262.—*Cola acuminata: a*, leafy branch, $\frac{1}{4}$ nat. size; also longitudinal section of fruit, cross and natural longitudinal section of seed showing embryo enlarged.

48. THEACEÆ (TERNSTRŒMIACEÆ). Tea Family.

The-a′se-e. L. *The-a* + aceæ, tea, fr. Chinese *Têh* or *Toha*—*i. e.*, native name simulating *Dea*, God. Trees, shrubs. Distinguished by alternate leaves; large showy solitary axillary flowers, sepals 5, petals 5, crenulate, stamens monadelphous; ovary 2–several-celled, superior; fruit 3–5-celled, woody capsule, dehiscent; tropics; stimulant, astringent, sedative.

Genus: **1. Thea.**

THEA. TEA.

Caffeina, Caffeine (Theine), $C_8H_{10}N_4O_2 + H_2O$, *official*.

Thea sinensis, *Linné*, and **Coffea arabica**, *Linné*. — A feeble basic substance (alkaloid) from the leaves of the former, and seeds of the latter (Rubiaceæ), also occurring in other plants; or prepared synthetically.

Habitat. S. E. Asia, China, India, Japan; cultivated.
Syn. Thea Bohea, Black Tea, Thea viridis, Green Tea; Fr. Thé; Ger. Thee.
The′a. L. see etymology, above, of Theaceæ.
Si-nen′sis. L. (Chinensis) Chinese, of or belonging to China—*i. e.*, its chief habitat.

Plant.—Evergreen shrub 1.2–2 M. (4–6°) high, much branched, bark brown, young twigs downy; leaves 5–10 Cm. (2–4′) long, petiolate, acute at both ends, oval, irregularly serrate, veins prominent, dark green; flowers in winter, 2.5 Cm. (1′) wide, yellowish-white; fruit 3-celled trigonous capsule, with thin brown woody pericarp; diluted alcohol or boiling water exhausts the leaves. Dose, ʒj–2 (4–8 Gm.).

Adulterations.—Prussian blue, indigo, turmeric, gypsum; the three first impart color to water, the last soon deposits; various leaves, recognized by shape, venation, margin, etc.

Commercial.—The plant, springing from seed, begins to yield satisfactory leaves in 3 years, and at 7 attains perfection, being about the height of a man. Three collections are made yearly (Feb., Apr., June), the first, consisting mostly of young leaves, having greatest value. Commercially we have *green* and *black*, the former being collected more carefully and quickly dried and containing most tannin, the latter, owing to slower process, undergoing partial fermentation which changes color and often impairs quality.

Constituents.—Caffeine (Theine) 1–5 p. c., volatile oil .6–1 p. c., theophylline (isomeric with theobromine), ademine, tannin 11–21 p. c., boheic acid, albumin, resin, wax, ash 4–6 p. c. (14 p. c. being phosphoric acid); leaves yield 40 p. c. of aqueous extract.

Theophyllina. Theophylline, $C_7H_8N_4O_2 + H_2O$, *official*.—(Syn., Theophyll., Dimethylxanthine; Synthetic—Theocine; Ger. Theophyllinum, Theophyllin, Theocin.) This organic base (alkaloid), isomeric with theobromine, is obtained sparingly from tea leaves, but mostly synthetically by a German patent under the name of theocine, wherein ammonia, carbon dioxide, potassium cyanide, acetic and formic acids are employed in a series of 12 reactions, and in fact becomes our first alkaloid made on a commercial scale by strictly synthetic methods. It is a white, crystalline powder, odorless, bitter taste, permanent, soluble in solutions of alkali hydroxides (dif. from caffeine), ammonia water, alcohol (80), water (100), more so in hot water, sparingly in ether; saturated aqueous solution neutral; melts at 271° C. (520° F.). *Tests:* 1. Dissolve .01 Gm. in hydrochloric acid 1 Ml. (Cc.), add potassium chlorate .1 Gm., evaporate to dryness, invert dish over one containing a few drops of ammonia water—residue purple, destroyed by fixed alkalies. 2. Aqueous solution with tannic acid T. S.—precipitate, soluble in excess of reagent; when dried to constant weight—loses 9.5 p. c.; incinerate .1 Gm.—ash non-weighable. *Impurities:* Caffeine, theobromine, paraxanthine, organic substances.

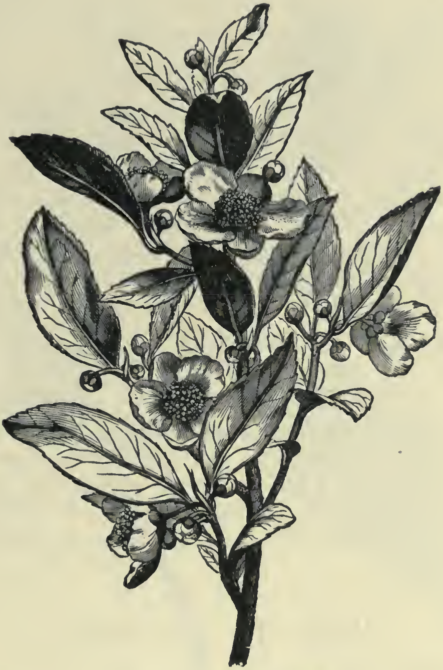


FIG. 263.—*Thea sinensis.*

PROPERTIES AND USES.—Claimed to be the best diuretic, increasing amount of urine as well as solids; cardiac affections, nephritis, dropsy; similar to caffeine and theobromine, but much more effective; may produce gastric disturbances, renal irritation, which can be obviated by using its salt—theophylline sodio-acetate. Dose, gr. 3–8 (.2–.5 Gm.), in warm tea.

Preparations.—(Unoff.) *Fluidextract,* dose, ♏xv–60 (1–4 Ml. (Cc.)). *Infusion* (*Tea*), dose, *ad libitum.*

Properties and Uses.—Similar to coffee, under Rubiaceæ, which see.

Allied Plants:

1. *Thea* (*Camel'lia,* after George Joseph Camel or Camelli, a Dutch Jesuit missionary and botanist) *japon'ica.*—Japan. An ornamental shrub with poisonous seed. *T. oleo'sa* (*Camellia oleif'era*) and *T. drupif'era.* Seeds resemble those of *T. sinensis* and yield a bland fixed oil—that of *T. drupifera* being fragrant.

2. *I'lex paraguen'sis* (*paraguayen'sis*), *Maté, Paraguay Tea.*—Ilicaceæ (Aquifoliaceæ); Brazil. Leaves contain caffeine .2–1.6 p. c., tannin 10–16 p. c., volatile oil, stearoptene, wax, glucoside, proteids 5 p. c., ash 4–8 p. c.

3. *Helian'themum canaden'se, Frost-wort* (*-weed*).—Cistaceæ. The dried herb, official 1850–1880; N. America. Perennial, 15–45 Cm. (6–18′) high, hoary; leaves 2.5 Cm. (1′) long, woolly beneath; flowers 2.5 Cm. (1′) broad, yellow, 5's, calyx pubescent, bitter, astringent; contains tannin 11 p. c., bitter glucoside. Used as a tonic, astringent, alterative for scrofula, syphilis, diarrhœa; gargle in scarlatina, sore throat; prurigo; large doses emetic. Dose, gr. 5–30 (.3–2 Gm.); decoction, extract, fluidextract (dil. alc.), infusion.

49. GUTTIFERÆ (CLUSIACEÆ). Gamboge (Mangosteen) Family.

Gut-tif'e-re. L. fem. pl. *Guttifer—gutta,* a drop, + *ferre,* to bear—*i. e.,* plants yield gum or resinous substances (juice) in drops. Trees or shrubs, allied to Hypericaceæ and Malvaceæ. Leaves coriaceous; flowers perfect; stamens many, distinct, mon- or poly-adelphous; sepals 2–8, often unequal, petaloid; petals 2–8 +; ovary 1-celled, superior; fruit edible; seed oily; tropics; purgative, timber.

Genus: **1. Garcinia.**

CAMBOGIA. GAMBOGE.

Garcinia Hanburii, *Hooker filius.* } A gum-resin.

Habitat. Annam, Camboja (Cambodia), Siam, Cochin-China.

Syn. Cambog., Pipe Gamboge, Gummi-resina Guttæ (Gutti), Gutta Gamba, Cambodia; Fr. Gomme-gutte; Ger. Gutti, Gummigutt.

Gar-cin'i-a. L. named after Laurent Garcin, French botanist, who first described it in 1734.

Han-bu'ri-i. L. in memory of D. Hanbury, named by Sir J. D. Hooker.

Cam-bo'gi-a. L. usually called Cambodia, a French protectorate in farther India, where it is indigenous.

Gamboge. The trade name, corruption of Camboge.

Plant.—A tree 10.5–15 M. (35–50°) high, with many spreading branches; bark orange-brown, thick; leaves 10–17.5 Cm. (4–7′) long, laurel-like; flowers Feb., diœcious, small, yellow, in 4's, staminate ones on pedicels (*pedicula'ta*) 6 Mm. ($\frac{1}{4}'$) long; fruit May–June, size of crab apple, 3 Cm. ($1\frac{1}{5}'$) in diameter; smooth, orange-green color, with 4 dissepiments, each having 1 seed 12–18 Mm. ($\frac{1}{2}$–$\frac{3}{4}'$) long. GUM-RESIN (gamboge), in hard, brittle, cylindrical pieces, usually hollow in centre, 10–20 Cm. (4–8′) long, 2–5 Cm. ($\frac{4}{5}$–2′) thick, grayish-orange-brown, longitudinally striate; fracture conchoidal, smooth, orange-red; odorless; taste very acrid. POWDER, bright yellow; microscopically—few or no starch grains; mounted in hydrated chloral T. S. particles slowly dissolve leaving scattered fragments of vegetable tissues. *Tests:* 1. Dissolves completely by successive treatments of ether or alcohol, and water. 2. Rub with water—yellow emulsion, darker and almost transparent upon adding ammonia water; + iodine T. S.—green (abs. of starch); not more than 35 p. c. should be insoluble in alcohol. *Solvents:* alcohol or ether dissolves at least 65 p. c. Dose, gr. $\frac{1}{2}$–5 (.03–.3 Gm.).

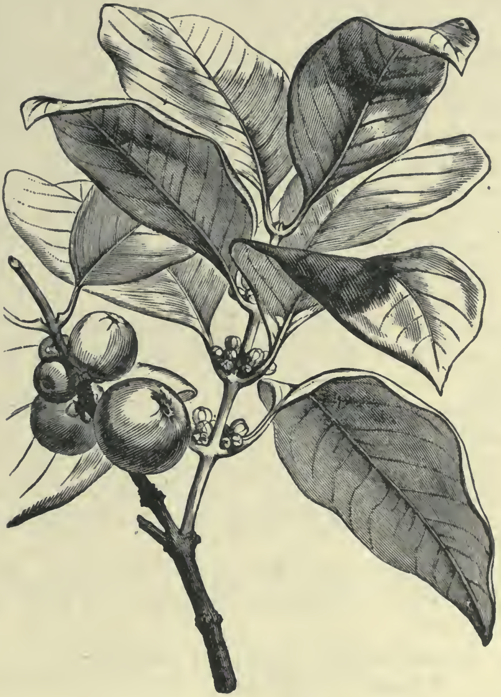


FIG. 264.—*Garcinia Hanburii.*

ADULTERATIONS.—Wheat and rice flour, sand, stones, nails, spikes, powdered wood or bark—mostly in the cake variety, giving greater hardness and coarser fracture.

Commercial.—Gamboge secretes in latex-tubes (ducts) in the middle bark and to some extent in the pith, alburnum, leaves, flowers, and fruit; it is at first a yellow milky juice obtained in drops from broken leaves, twigs, or artificial incisions, being caught in leaves, cocoanut shells or bamboo joints. There are two varieties: 1, *Pipe* (*Roll, Fine*), the best, resulting from making, at the beginning of the rainy season, June–Oct., a spiral incision in the bark half around the tree trunk from the ground upward a number of feet, and collecting the slowly exuding juice in a hollow bamboo joint placed at the lower end of the incision, requiring 1–2 months to fill and harden, in which the contraction toward the sides often affords a central cylindrical cavity; upon cracking off the bamboo shell that usually imparts its markings the contents are ready for market; trees should only be tapped biennially and each should yield 3 bamboo joints 50 Cm. (20′) long, 4 Cm. (1⅗′) thick; 2, *Cake* (*Lump, Saigon, Cochin, Coarse*), inferior, resulting from collecting the juice in leaves and various vessels, being subjected to exposure and adulteration, thereby becoming less uniform and brittle with dull brownish non-conchoidal fracture; usually in masses, 2–3 pounds (.7–1 Kg.), sometimes much larger, being pressed or run into boxes or tubs. Enters market via Canton, Calcutta, Singapore, Saigon, Bangkok, etc.

CONSTITUENTS.—Gum 16–25 p. c., resin (cambogic acid) 66–80 p. c., volatile oil, phenol ester, methyl alcohol and other alcohols, isovitinic and acetic acids, liquid with fruity odor resembling an aldehyde or ketone, ash 1–3 p. c.

Gum.—Soluble in cold water like gum arabic (*arabin*), but not identical with it, as it is not precipitated by lead acetate, ferric chloride, sodium silicate, or sodium borate.

Resin.—Soluble in ether and alcohol, forming golden-yellow tinctures, also in alkaline solutions with red color, from which it is precipitated unaltered by acids. It has acid characteristics, hence sometimes called cambogic acid, and upon it the coloring matter and medicinal properties depend; with salts of heavy metals forms precipitates called cambogiates.

PREPARATIONS.—1. *Pilulæ Catharticæ Compositæ*, ¼ gr. (.016 Gm.).

Unoff. Prep.: Pilula Cambogiæ Composita, 16 p. c. +, dose, gr. 4–8 (.26–.5 Gm.).

Poisoning: Similar to aloes, colocynth, elaterin, etc.

PROPERTIES.—Drastic, hydragogue cathartic; in small repeated doses diuretic. Usually produces much griping, nausea and vomiting when taken in full doses, so that generally it is combined with other cathartics, as calomel, jalap, potassium bitartrate or carbonate, etc.; it greatly irritates the alimentary canal, especially the small intestine, when taken in excess, and gr. 60 (4 Gm.) have occasioned death; it augments intestinal glands' secretion, but not of bile, and mostly passes in the fæces, but some is absorbed, causing yellow urine.

USES.—Liver trouble from malaria; renal dropsy, uræmic conditions, congestion of the brain, tænifuge (combined usually with tænicides), vermifuge, dropsy; very uncertain in veterinary practice. Mostly used as pigment in water-color painting. The powder when rubbed up with water shows strongly the "Brownian movement" under the microscope.

Allied Plants:

1. Several guttiferous plants of Southern India, not restricted, however, to the Cambodia province, as is the official, are almost identical with this latter and yield a similar juice: *Garcinia Morel'la* (staminate flowers sessile), Ceylon, S. India; *G. travanco'rica*, Travancore; *G. picto'ria*, Madras peninsula, etc.; *G. Mangosta'na, Mango Fruit*, India, astringent; *G. purpu'rea* (*in'dica*) India; the seeds of this are exposed to the sun and then boiled in water, when 10–20 p. c. of a fixed oil (kokum-butter) is obtained.

2. *Canel'la Wintera'na* (*al'ba*), *Canellæ Cortex, White Cinnamon.*—Canellaceæ. The dried inner bark, official 1820–1880; W. Indies. Tree 9–15 M. (30–50°) high, recognized by whitish bark; leaves thick; flowers white, aromatic; fruit berries 12 Mm. (½′) long, blackish. Bark in quills 15–60 Cm. (6–24′) long, 2–4 Cm. ⅘–1⅗′) in diameter, the bark 3 Mm. (⅛′) thick, deprived of gray corky layer, orange-red, with scars, inside striate with resin cells, cinnamon odor; taste bitter, biting; contains volatile oil (having eugenol) 1 p. c., resin 8 p. c., bitter principle. Used in gastric debility, menorrhagia, amenorrhœa, as stimulant, tonic, condiment. Dose, gr. 5–30 (.3–2 Gm.). *Pulvis Aloes* (*80*) *et Canella* (*20*), *Hierapicra*, official 1820–1850, dose, gr. 5–10 (.3–.6 Gm.).

3. *Vio'la tri'color, Pansy.*—Violaceæ. The flowering herb, official 1880–1890; Europe, N. America, cultivated. Plant 10–30 Cm. (4–12′) high, angular; leaves roundish, cordate; flowers variegated (yellow, whitish, blue, purplish); taste bitter; contains salicylic acid .1 p. c., bitter principle, resin. Used as alterative, expectorant; large doses emetic, cathartic; skin diseases, scrofula, syphilis, bronchitis, nephritis. Dose, gr. 15–60 (1–4 Gm.); in decoction, infusion, extract. *V. peda'ta, Bird's-foot* or *Blue Violet*, The herb and rhizome, official 1820–1880; Europe, N. America. Plant acaulescent; leaves 3–5-divided; flowers bluish; rhizome 25 Mm. (1′) long, 18 Mm. (¾′) thick, bitter, acrid. Used as the preceding.

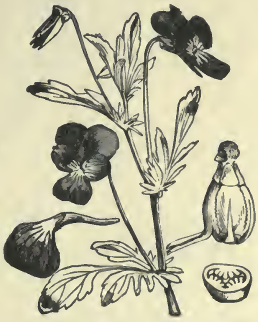


FIG. 265.—*Viola tricolor.*

4. *Passiflo'ra incarna'ta. Passion-flower.*—Passifloraceæ. The dried herbage; S. United States. Slender climbing plant, flowers flesh-color; rhizome thin, yellowish-brown, hollow with nodes; slight odor and taste—unpleasant, fatty; contains alkaloid. Externally—hemorrhoids, erysipelas, burns; dose, gr. 5–10 (.3–.6 Gm.), tincture (dil. alc.) 20 p. c., ♏x–30 (.6–2 Ml. (Cc.)), inspissated juice of leaves, ʒj–4 (4–15 Ml. (Cc.)).

5. *Tur'nera diffu'sa* (*microphyl'la*) var. *aphrodisi'aca, Damiana.*—Turneraceæ. The leaves; W. Mexico, Lower California, Texas. Leaves alternate, 10–25 Mm. (⅖–1′) long, wedge-shaped base, 6–12-toothed, obovate, light green, with whitish hairs, aromatic, mint-like taste; contains volatile oil 1 p. c. (amber-color, aromatic odor, warm

camphoraceous taste); damianin, 2 resins, tannin. Aphrodisiac, tonic, stimulant, laxative. Dose, ʒ ss–2 (2–8 Gm.), fluidextract (75 p. c. alcohol).

6. *Ce'reus* (*Cac'tus*) *grandiflo'rus, Night-blooming Cereus.*—Cactaceæ. The fresh, succulent stems of the wild growing plant, collected when plant is in flower; usually preserved in alcohol; Mexico, W. Indies; cultivated. Small shrub, .3–1 M. (1–3°) high, stem green, fleshy, branching, 5–6-angled, angles 6–8-spined, flowers white, sessile, large, fragrant, opening at night, petals and stamens numerous, fruit white berry, size of an egg, acrid taste; contains cactine, acrid resinous glucoside, resins. Cardiac stimulant (tonic), diuretic, similar to digitalis, but non-cumulative, counter-irritant; cardiac palpitation and weakness, heart failure from valvular disease, angina pectoris, aortic regurgitation, dropsies, low fevers, Graves' disease, tobacco, toxemia, sexual exhaustion. Dose, gr. 5–10 (.3–.6 Gm.); decoction, 5 p. c., ʒ j–2 (4–8 Ml. (Cc.)); fluidextract; tincture (alcohol), 50 p. c., ♏xv–30 (1–2 Ml. (Cc.)).

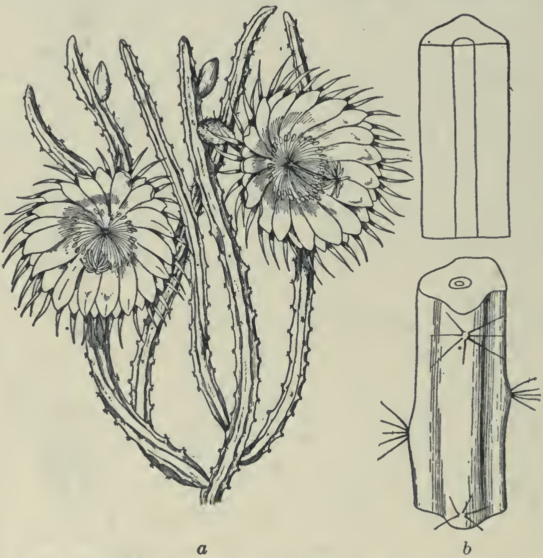


Fig. 266.—*Cereus grandiflorus:* *a*, flowering stem; *b*, section of stem, showing cross and longitudinal sections.

7. *Lophoph'ora* (*Anhalo'nium*) *Lewin'ii, Mescale.*—Mexico. This small plant yields the mescale buttons, which are used by the Rio Grande Indians to produce intoxication during religious ceremonies, also the alkaloidal pellotine (pellotinum), $C_{13}H_{21}NO_3$, which is unirritating, consequently may well be employed hypodermically as a hypnotic; resembles somewhat cannabis. Slightly slows the pulse, produces mental and bodily weariness, sleep without untoward symptoms; excessive quantities produce spasms resembling strychnine-poisoning. Hysteria, insomnia, angina pectoris, asthmatic dyspnœa, hypochondriasis. Dose (pellotine), gr. ½–1 (.03–.06 Gm.).

50. THYMELÆACEÆ. Mezereon Family.

Thim-e-le-a′se-e. L. *Thymelæ-a* + aceæ, Gr. *θυμελαία*, a plant, fr. *θύμος*, courage (thyme), + *ἐλαία*, olive tree (oil), referring to the reviving odor; or *θύω*, to perfume, being used in temples as incense. Trees, shrubs, rarely herbs. Distinguished by toughness and acridity of bark due to bast-fibres. Leaves entire; flowers perfect; calyx regular, simple colored, 4–5-lobed, inferior; stamens perigynous, twice the calyx lobes; ovary 1-celled, superior; ovule 1; fruit nut or drupe; tropics; narcotic, poisonous.

Genus: **1. Daphne.**

MEZEREUM. MEZEREUM.

Daphne { **Mezereum,** *Linné,*
Gnidium, *Linné,*
Laureola, *Linné.* } The dried bark.

Habitat. Europe, mountainous regions, (Siberia, spontaneous in Canada, New England; cultivated for medicine and ornament).

Syn. Mezereon, Spurge Laurel (Olive), Spurge Flax, Lady Laurel, Wild Pepper; Mezerei Cortex, Cortex (Thymeleæ) Coccognidii; Fr. Écorce de Mézéréon-, de Garou–, de Lauréolé-, de Thymélée, Bois gentil; Ger. Seidelbast, Kellerhals (rinde).

Daph′ne. L. fr. Gr. *δάφνη* the laurel or bay tree, into which a nymph, beloved of Apollo, was metamorphosed; lit. fr. *δαίω* to burn, + *φωνή* a sound—*i. e.*, it crackles when burning.

Me-ze′re-um. L. medieval name fr. Pers. *mazariyum*, which then was applied to species of *Daphne*.

Gnid′i-um. L. fr. *gnidia*—*i. e.*, the ancient name of the laurel.

Lau-re′o-la. L. dim. of *laurea*, a laurel, garland—*i. e.*, a little laurel, garland, a laurel-branch.

Plants.—Small, slender, hardy, straggling shrubs, .3–1.3 M. (1–4°) high; stems branching, smooth, young branches tomentose; leaves 5–7.5 Cm. (2–3′) long, obovate-, linear-lanceolate, bluntly pointed or acute, sessile, entire, smooth, dark green; flowers, Feb.–April, before leaves appear, in small clusters, sessile, fragrant, tubular, 5–15 Mm. ($\frac{1}{5}$–$\frac{3}{5}$′) broad, rose-red (1), white (2), yellowish-green (3); fruit, July, ovate, 3–9 Mm. ($\frac{1}{8}$–$\frac{1}{3}$′) long, sessile, succulent, bright red (1), scarlet (2), purplish-black (3). Bark, in flexible, tough quilled pieces, somewhat flattened strips, .6–1 M. (2–3°) long, .3–1 Mm. ($\frac{1}{75}$–$\frac{1}{25}$′) thick, yellowish-, olive-brown (1), purplish-brown (2), purplish-gray (3), smooth, numerous lenticels giving transversely striated appearance, occasionally with many circular, brownish-black apothecia; outer corky layer easily separable from middle bark, which varies from light green to olive-brown with more or less detached bast-fibres; inner surface yellowish-

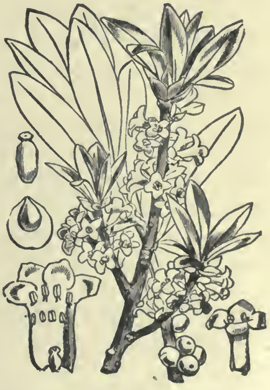


Fig. 267.—*Daphne Mezereum.*

white; satiny lustrous, finely striate; fracture tough, fibrous, inner bark lamellated; odor very slight; taste at first slight, gradually and increasingly pungent, acrid. POWDER, grayish-brown; microscopically —numerous bast-fibres, often with attenuated ends, walls free from pores; fragments of yellowish-brown cork-cells, starch-bearing medullary rays; few starch grains, .003–.015 Mm. ($\frac{1}{8325}$–$\frac{1}{1625}$′) broad. *Solvents:* boiling water; alcohol. Dose, gr. 1–10 (.06–.6 Gm.).

Commercial.—Plants flourish well in shade or sunshine, the *D. Mezereum,* best in peat and loam soil, with abundant moisture in summer, carefully avoiding wetting the bark in needed irrigation, as that causes rotting; var. *alba* has white flowers, yellow fruit (berries); var. *autumnalis* has purple flowers, Oct.–Jan.; *D. Gnidium,* best in dry, sunny locations, heaths, pine woods, France, Spain, Portugal; flowers July–Sept.; *D. Laureola,* best in shade, hedgebanks, in woods, copses, chiefly on calcarious or clay soil. Bark should be collected Nov.–Feb., and while that of the root is most effective its insufficient supply has compelled the acceptance of that from the stem; leaves, wood, roots, flowers possess medicinal properties in the order named. Bark when dried is made into rolls or bundles, most coming to us from Germany. In powdering, muzzle the nostrils, or add occasionally a little water, to prevent inhaling poisonous dust.

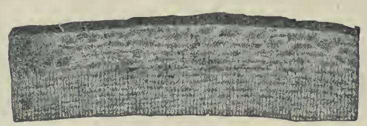


FIG. 268.—Mezereum: transverse section, magnified 15 diam.

CONSTITUENTS.—Acrid resin, Acrid volatile oil, Daphnin, wax, sugar, yellow coloring matter, malic acid; by dry distillation yields umbelliferon.

Acrid Resin (**Mezerein**).—The vesicant content; obtained by boiling the bark with alcohol, distilling, and treating residue with water, thus leaving resin; it is blackish-green, hard, brittle, permanent, acrid taste.

Daphnin, $C_{15}H_{16}O_9$.—Bitter glucoside; obtained by precipitating the decoction of alcoholic extract with lead subacetate, filtering, decomposing with hydrogen sulphide, evaporating filtrate, treating residue with alcohol or water, crystallizing; soluble in alkalies with yellow color, insoluble in ether, blue with ferric salts, not acrid, with acids forms glucose and daphnetin; little value medicinally, as that resides in the volatile oil and its transformed resin.

PREPARATIONS.—1. *Fluidextractum Sarsaparillæ Compositum,* 3 p. c.

Unoff. Preps.: Decoction. Extract (alcohol), dose, gr. 1–2 (.06–.13 Gm.). *Fluidextract* (alcohol 80 p. c.), dose, ♏j–10 (.06–.6 Ml. (Cc.)). *Ointment.*

The extract and fluidextract are used mostly in liniments.

PROPERTIES.—Similar to other drugs with volatile oils, and to sanguinaria; stimulant, diuretic, diaphoretic, alterative, sialagogue, vesicant.

Uses.—Syphilis, scrofula, rheumatism, skin diseases. Externally—local irritant like cantharides, applied to indolent ulcers to make them again active, also to maintain discharges from setons, fly blisters, etc.

Poisoning: Have severe intestinal irritation, vomiting, purging, cold sweats, prostration, collapse, convulsions death. Evacuate stomach with warm albuminous or mucilaginous drinks, follow with milk, fatty oils, and opium for depression.

Incompatibles: Tannin and free acids precipitate the glucoside, and water the resin.

Synergists: Alteratives except colchicum.

Allied Products:

1. *Daphne salicifo'lia.*—The leaves, Mexico; used natively as a vesicant.
2. *Fruits* of the various species contain 31 p. c. of fixed oil.

51. LYTHRACEÆ (PUNICACEÆ). Loosestrife Family.

Lith-ra'se-e. L. *Lythr-um* + aceæ, fr. Gr. *λύθρον*, gore—*i. e.*, from its purple flowers. Herbs, shrubs, often 4-sided; distinguished by containing astringent principle, coloring agent. Leaves exstipulate; calyx tubular, persistent, bearing deciduous petals and stamens; lobes valvate; petals 4–7, wrinkled; stamens 4–14, perigynous, inserted below petals; ovary 1–2–6-celled, superior; ovules many; style 1; stigma rarely 2-lobed; fruit capsule, membranous, dehiscent, surrounded by non-adherent calyx-tube; seeds many, exalbuminous; temperate climates, tropics; astringent, dye.

Genus: **1. Punica.**

GRANATUM. POMEGRANATE.

Punica Granatum, *Linné.* { The dried bark of the stems and roots, with not more than 2 p. c. of wood, foreign matter.

Habitat. S. W. Asia, India, Persia, Arabia, China, Japan, E. and W. Indies; naturalized in subtropics, S. United States, etc.; cultivated for fruit, ornamental flowers.

Syn. Granat., Pomegranate Bark, Grenadier, Punic (Carthaginian, Garnet) Apple; Granati Cortex; Fr. Écorce de (Grenadier) Balaustier; Ger. Granatrinde.

Pu'ni-ca. L. *punicus*, of or belonging to Carthage, near which city it is said to have first been found, or fr. *puniceus*, scarlet—*i. e.*, the color of its flowers.

Gra-na'tum. L. *granatus*, having many grains or seeds, fr. *granum*—*i. e.*, the many-seeded fruit.

Pome'gran-ate. L. *pomum*, a fruit, + *granatus*, grained.

Plant.—Shrub or small tree, 4.5 M. (15°) high, branches angular, with spiny ends; young shoots and buds red; leaves 2.5–5 Cm. (1–2′) long, shining, lanceolate, entire, half evergreen; flowers June–Sept., large; calyx shining, scarlet, tubular, 3 Cm. (1⅕′) long; corolla crimson, 5–7 petals; fruit (balausta), 5–10 Cm. (2–4′) broad, resembles an orange, quince, or tomato, 5–8-angled over the dissepiments, short-necked at top. Internally, below the median line, divided by a diaphragm into two stories—upper with 5–9 irregular cells, lower and smaller with 1–3 vertical partitions (cells); seeds angular 12 Mm. ($\frac{1}{2}'$) long, so numerous that they, with the thin surrounding edible pulp, fill entire fruit. Bark (stem), in somewhat flattened or transversely curved pieces, quills, 2–8 Cm. ($\frac{4}{5}$–$3\frac{1}{5}'$) long; bark .5–3.5 Mm. ($\frac{1}{50}$–$\frac{1}{5}'$) thick, yellowish-brown, with grayish patches of foliaceous lichens with their brownish-black apothecia, longitudinally wrinkled, small elliptical lenticels, abraded patches of cork; inner surface yellowish-brown, finely striate; fracture short, smooth, inner bark yellowish-green; odor slight; taste astringent, bitter, nauseous; (root), transversely curved pieces, brownish-yellow, irregular patches of cork; internally dark yellow, medullary rays extending nearly to outer surface. Powder, yellowish-brown; microscopically—calcium oxalate rosette aggregates, numerous starch grains .002–.01 Mm. ($\frac{1}{12500}$–$\frac{1}{2500}'$) broad, fragments of whitish cork, stone cells, long wood-fibres, tracheæ. *Tests:* 1. Macerate for 1 hour 1 Gm. in distilled water 100 Ml. (Cc.); add to 10 Ml. (Cc.) of yellow filtrate a drop of ferric chloride T. S.—bluish-black precipitate; to another 10 Ml. (Cc.) add 40–50 Ml. (Cc.) of lime water—orange-brown, flocculent precipitate. Should be kept in tightly-closed containers. *Solvents:* boiling water; diluted alcohol. Dose, ʒss–2 (2–8 Gm.).

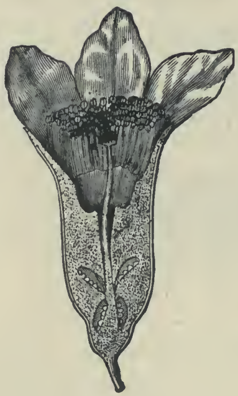


Fig. 269.—*Punica Granatum:* flower.

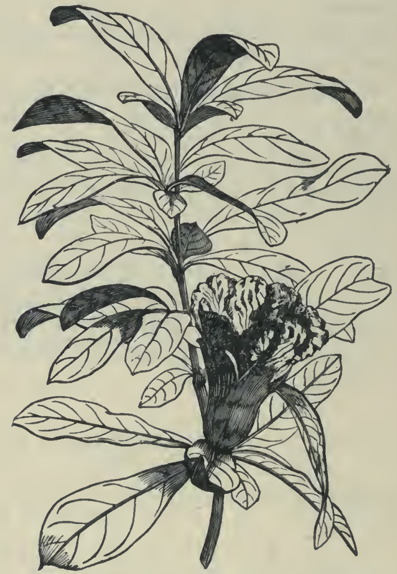


Fig. 270.—*Punica Granatum:* flowering branch.

Substitutions.—1, *Bux'us semper'virens, Boxwood Bark;* 2, *Berberis vulgaris, Barberry Bark;* neither contain tannin, hence infusions do not precipitate blue-black with iron like pomegranate bark; they also are very bitter, and the former has a nearly white inner surface; 3, *Granati Fructus Cortex;* this contains tannin 19–28 p. c., extractive 21 p. c., gum 34 p. c., and has the same effect as the bark.

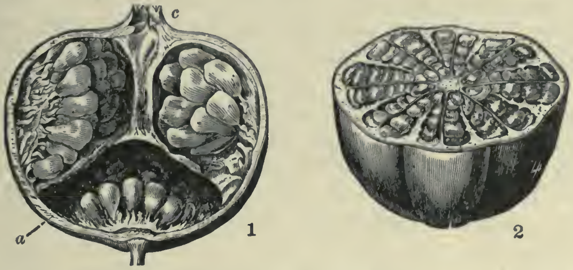


FIG. 271.—*Punica Granatum: 1,* longitudinal cross-section; *2,* transverse cross-section; *a,* inner rind and ovules; *c,* the remaining calyx.

Commercial.—Root-bark is three times stronger in alkaloids than stem-bark, but both deteriorate rapidly with age owing to the alkaloids undergoing decomposition; the white-flowered plant yields the richest bark which is imported chiefly in the dry state from France, Italy, although we use much of our native product. In addition to the bark occasionally the flowers, fruit, rind, and acidulous seed-coating are employed domestically; some prefer the bark from uncultivated plants.

CONSTITUENTS.—Tannic acid 20–22 p. c., Alkaloids 1.71 (black-flowered)–2.43 (red-flowered)–3.75 p. c. (white-flowered)—Pelletierine (punicine) .5–1.5 p. c., isopelletierine, methylpelletierine, pseudopelletierine (granatonine), mannite (punicin, granatin), gallic acid, sugar, gum, pectin, calcium oxalate, ash 10–16 p. c.

Tannic Acid, $C_{20}H_{16}O_{13}$.—This is a mixture of gallotannic acid and punicotannic (granatotannic) acid, the latter insoluble in alcohol, ether, precipitates gelatin, tartar emetic, iron salts, with dilute acids splits into sugar and ellagic acid.

Pelletierine, $C_8H_{15}NO$ (in honor of Pelletier).—This is obtained by mixing bark with milk of lime, displacing with water, exhausting percolate with chloroform. It is regarded by Tanret, its discoverer, to be the anthelmintic constituent, and is a colorless, oily, aromatic alkaloid, resinifying on exposure, soluble in water, alcohol; forms crystalline salts (nitrate, sulphate, tannate, etc.)—considered to be a mixture of the several alkaloids. Dose, gr. 8–24 (.5–1.6 Gm.).

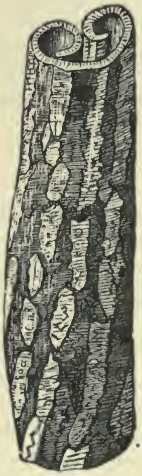


FIG. 272. — Granati cortex: bark of the root.

Pelletierinæ Tannas, Pelletierine Tannate, *official.*—(Syn., Pellet. Tann., Punicine Tannate; Fr. Tannate de Pelletierine; Ger. Pelletierinum tannicum, Gerbsaures (Pelletierin) Punicin.) This is a mixture in varying proportions of the tannates of four alkaloids (punicine, iso-punicine, methyl-punicine, pseudo-punicine), and is obtained by mixing ground bark with milk of lime, percolating with water until exhausted, shaking out percolate with chloroform, and chloroformic solution of free alkaloids with very dilute sulphuric acid; to neutral solution of mixed sulphates add solution tannic acid, whereby tannates are precipitated, dry. It is a light yellow, odorless, amorphous powder, astringent taste and weak acid reaction, soluble in water (240), alcohol (16), ether (420), warm dilute acids; insoluble in chloroform. *Tests:* 1. Aqueous solution with ferric chloride T. S.—blue-black color. 2. Cold solution of .1 Gm. in 4 Ml. (Cc.) of distilled water + 1 Ml. (Cc.) of diluted hydrochloric acid, + platinic chloride—no precipitate (abs. of foreign alkaloids). Should be kept dark, in small, well-closed containers. Dose, gr. 4–24 (.26–1.3 Gm.) in ℥j (30 Ml. (Cc.)) of water.

Preparations.—1. *Fluidextractum Granati.* Fluidextract of Pomegranate. (Syn., Fldext. Granat., Fluid Extract of Pomegranate; Fr. Extrait fluide d'Écorce de (Grenadier) Balaustier; Ger. Granatrindenfluidextrakt.)

Manufacture: Similar to Fluidextractum Ergotæ, page 60; 1st menstruum: alcohol 50 Ml. (Cc.), water 40, glycerin 10; 2nd menstruum: diluted alcohol. Dose, ʒss–1 (2–4 Ml. (Cc.)).

Unoff. Preps.: Decoctum Granati Corticis, 20 p. c., dose, ℥ss–2 (15–60 Ml. (Cc.)). *Rind,* dose, gr. 15–30 (1–2 Gm.).

Properties.—Anthelmintic, tænifuge, astringent.

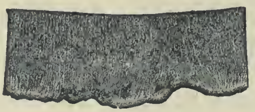


Fig. 273.—Granati cortex: transverse section, magnified 10 diam.

Uses.—The ancients knew its value as a vermifuge (Celsus, Dioscorides, Pliny). In Hindustan, Mohammedan physicians used it in tænia, one of whom made public the secret in 1804; French physicians prefer the wild-grown plant. Externally and internally astringent; large doses occasion vomiting, purging, cramps, numbness in the legs, giddiness, dim vision, increased urine. The rind is also astringent in diarrhœa, leucorrhœa, hemorrhage, cancerous and other ulcers of uterus and rectum; intermittent fever. For tape-worm take decoction made by boiling bark ℥ij (60 Gm.) + water Ojss (.7 L.) down to Oj (.5 L.); give this in 3 divided doses at hour intervals in the morning on empty stomach. It is well, a couple of hours after administration, to follow with castor oil ℥j (30 Ml. (Cc.)) or compound tincture of jalap ℥j (30 Ml. (Cc.)). The worm should be passed sitting in a tepid sitz-bath, thus preventing the expelled portion tearing from the head by its weight; it passes usually in a knotted mass. Pomegranate may also be used for tanning, dyeing; the fruit as a refreshing, cooling article of food.

52. MYRTACEÆ. Myrtle Family.

Mer-ta'se-e. L. *Myrt-us* + aceæ, Gr. *μύρτος*, myrtle, fr. *μύρον*, perfume—*i. e.*, characteristic of some species. Trees, shrubs; distinguished by aromatic, pungent properties (vol. oil); stamens 8–10 +; leaves exstipulate, opposite, dotted with marginal vein; calyx and petals 4–5; ovary inferior, 1–6-celled; fruit dry or succulent; seeds exalbuminous; temperate climates, tropics; aromatic, stimulant, carminative (vol. oil), diaphoretic, antispasmodic, astringent, spices, perfumery, edible fruit; timber.

Genera: **1. Melaleuca (Cajuputi). 2. Eugenia. 3. Pimenta (Myrcia). 4. Eucalyptus.**

CAJUPUTUM. CAJUPUT.

Oleum Cajuputi. Oil of Cajuput, *official.*

Melaleuca Leucadendron, *Linné,* var. **Cajeputi,** var. **minor.**	A volatile oil distilled from the fresh leaves and twigs.

Habitat. E. India Islands, Celebes, Bouro, Amboyna, Moluccas, Philippines, Cochin China, Australia.

Syn. Kayu–putu, White Tree (Wood), Pepperbark; Ol. Cajup., Cajuput Oil, Oil of Cajeput, Oleum Cajeputi; Fr. Huile (Essence) de Cajeput; Ger. Gajeputöl.

Mel-a-leu'ca. L. fr. Gr. *μέλας*, black + *λευκός*, white,—*i. e.*, bark of the trunk is blackish, that of the branches is whitish.

Leu-ca-den'dron. L. fr. Gr. *λευκός*, white, + *δένδρον*, a tree—*i. e.*, general appearance of the tree.

Caj-e-pu'ti (better Caj-u-pu'ti). L. fr. Malay. *kayu*, tree, + *putih*, white —*i. e.*, appearance of the branches.

Mi'nor. L. *minor, minus*, less, smaller—*i. e.*, plant smaller than other species, also smaller flower-heads and leaves.

Plants.—Small trees, 9–12 M. (30–40°) high; bark gray, brittle, splitting into thin layers; leaves 5–10 Cm. (2–4') long, blade twisted, lanceolate; flowers 5–7.5 Cm. (2–3') long, greenish to whitish, silky, pubescent, spikes; fruit woody, hard, sessile, dehiscing into 3 valves.

Constituents.—Volatile oil, mucilage, pectin.

Oleum Cajuputi. Oil of Cajuput.—This oil, obtained by water or steam distillation, is a colorless, yellowish, greenish (usually due to copper) liquid, peculiar, agreeable, distinctly camphoraceous (cineol) odor, aromatic, slightly bitter taste, soluble in 1 vol. of 80 p. c. alcohol, sp. gr. 0.918, lævorotatory; contains 50–67 p. c. of cineol (cajuputol, eucalyptol), $C_{10}H_{18}O$, also the alcohol terpineol, $C_{10}H_{17}OH$, several terpenes—*l*-pinene, etc., valeric and benzoic aldehydes, which upon oxidation impart acid reaction. It is imported mostly from Celebes (Macassar), Bouro (islands), some from Singapore, Java, Manila, in emptied beer and wine bottles, 25 packed in a crate, or in copper cans (rare). Should be kept cool, in well-stoppered, amber-colored bottles. Dose, ♏ij–10 (.13–.6 Ml. (Cc.)), emulsion, pill, on sugar; externally in liniments.

Adulterations.—Copper from shipping cans (rare), many cheaper oils, as camphor, rosemary, turpentine (French turpentine, owing to its *l*-pinene, being difficult to detect), also these sometimes colored with resin of milfoil, all rendering action with iodine more violent.

Properties.—Same as oil of clove; carminative, stimulant, diaphoretic, vermifuge, parasiticide, rubefacient, counter-irritant.

Uses.—Rheumatism, myalgia, spasmodic affections of the stomach and bowels, catarrh of bladder, low fevers, gout, colic, cholera morbus, dysmenorrhœa, laryngitis, bronchitis, toothache, chilblains.

Preparation.—(Unoff.): *Spiritus Cajuputi* (Br.), 10 p. c., dose, ♏v–20 (.3–1.3 Ml. (Cc.)).

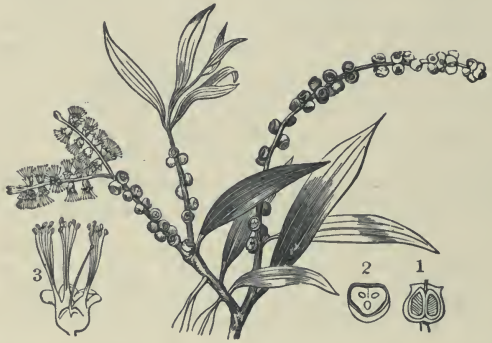


Fig. 274.—*Melaleuca Leucadendron* var. *Cajeputi*—small branches with leaves, buds, and flowers: *1*, vertical section of fruit; *2*, transverse section of ovary; *3*, vertical section of flower.

CARYOPHYLLUS. CLOVE.

Eugenia aromatica, (*Linné*) *Kuntze.* { The dried flower-buds, with not more than 5 p. c. of peduncles, stems, foreign matter.

Habitat. Molucca (Spice or Clove) Islands, five in number, N. E. of Celebes, now mostly abandoned there, but cultivated in Indian Ocean islands, Amboyna group, Sumatra, Malacca, Penang, etc., S. America, Brazil, Guiana, Cayenne, Africa, Zanzibar, West Indies.

Syn. Caryoph., Cloves, Mother Cloves, Caryphylli Aromatica; Br. Caryophyllum; Fr. Girofle, Clou (aromatiques) de Girofle; Ger. Caryophylli, Gewürznelken, Nägelein.

Eu-ge'ni-a. L. fr. Gr. εὐ, well, + γενής, born—noble birth—*i. e.*, in honor of Prince Eugene of Savoy, a great patron of botany (died 1736).

Ar-o-mat'i-ca. L. *aromaticus*, fragrant—*i. e.*, its aromatic, fragrant odor.

Car-y-o-phyl'lus. L. fr. Gr. κάρυον, a nut, + φύλλον, a leaf—*i. e.*, referring to the appearance of flower buds.

Clove. L. *clavus*, a nail—*i. e.*, the resemblance of its dried flowers.

Plant.—Handsome evergreen tree, 9–12 M. (30–40°) high, much branched, forming a pyramidal crown; bark yellowish; leaves 10 Cm. (4′) long, 5 Cm. (2′) wide, entire, smooth, glandular, parallel veins to midrib, petiolate; flowers 15–20, rose-color, cymes; fruit berry-like. Flower-buds (clove), tack-shaped, 10–17.5 Mm. ($\frac{2}{5}$–$\frac{3}{4}$′) long, dark brown, consisting of a stem-like, solid, inferior ovary, obscurely

4-angled, terminated by 4 calyx teeth, and surmounted by a nearly globular head, consisting of 4 petals enclosing numerous curved stamens and 1 style; odor strongly aromatic; taste pungent, aromatic, followed by slight numbness; pressed strongly between thumb-nail and finger—volatile oil visible; should not float horizontally on water; stems, separate or attached, sub-cylindrical, 4-angled, 25 Mm. (1′) long, 4 Mm. ($\frac{1}{6}$′) thick, simple, branched, jointed, less aromatic than flower-buds. Powder, dark brown; microscopically—cellular fragments with large oil reservoirs, spiral tracheæ, few fusiform bast-fibres, rosette aggregates of calcium oxalate, many tetrahedral pollen grains; presence of stems show stone cells of large lumina with yellowish-brown substance; volatile extractive soluble in ether 10 p. c. *Solvents:* alcohol (volatile oil, resin); water (odor—part of volatile oil but none of the pungent resin). Dose, gr. 5–10 (.3–.6 Gm.).

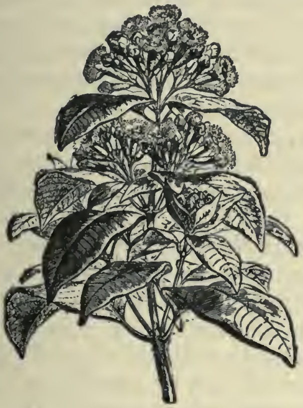


Fig. 275.—*Eugenia aromatica.*

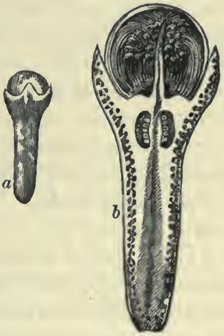


Fig. 276.—Caryophyllus: *a*, natural size; *b*, longitudinal section magnified.

Adulterations.—Flower-buds: Clove-stalks, 2 Mm. ($\frac{1}{12}$′) thick, brown, contain volatile oil 4–5 p. c., for which they are imported; mother clove (clove fruit, anthophylli) collected just before ripe, 2.5 Cm. (1′) long, resemble clove, but thicker, lighter, weaker, with 4-lobed calyx, each cell 1–2-seeded, contain volatile oil 2–4 p. c.; exhausted clove, such as have undergone partial or complete exhaustion and distillation; pimenta, different shape and aroma; Powder: All of the above—detected chiefly by peculiar starch grains and weakness of the preparations; cassia; ginger; sand; starch; flour; pepper shells. Oil: That from which eugenol has been abstracted or foreign eugenol added; clove-stem oil, alcohol, oils of turpentine, cinnamon, pimenta and copaiba, petroleum, fixed oils, phenol.

Commercial.—Trees yield when 6 years old, reach perfection at 12, and thence decline until, at 20, they perish. Clove (flowers, buds) at first are white, then green, pink, and bright red, being collected at the pink stage by hand-picking on ladders and platforms, or by beating the trees with bamboos and catching the falling buds upon outspread cloths, after which they are dried by sun or slowly by fire. Each tree yields 5 pounds (2.3 Kg.), which are disposed of at 10 cents per pound (.5 Kg.). Clove was unknown to the ancients, having been brought to Europe by the Arabians and Venetians, while the Portuguese and Dutch long monopolized the trade. Now mostly from Zanzibar, the finest from Penang, some from Pemba, or via Bombay; however, much of our supply from W. Indies, Cayenne, Guiana, etc. There are three varieties: 1, *Molucca* (*Amboyna*), thickest, heaviest, darkest, most oily and aromatic; two annual harvests, June, Dec., in the Moluccas; 2, *Sumatra* (*Bencoolen*), considered by some of equal high grade as the preceding; 3, *S. American*, usually not so fine, but the freshest contain volatile oil 10–15 p. c.

Clove(s) that are light (floating horizontally on water), small, soft, wrinkled, of pale color, feeble taste and smell, often without corolla bud or "head," are inferior from having been treated with a menstruum or careless picking (including immature green and red buds) and drying (which should be done quickly and without exposure to bad weather), and should not be used direct or in obtaining the oil.

CONSTITUENTS.—Volatile oil 18 p. c., eugenol, caryophyllin, tannin 10–13 p. c., resin (tasteless) 6 p. c., gum 13 p. c., vanillin, green wax, cellulose 28 p. c., water 18 p. c., ash 4–8 p. c. (of which .5 p. c. is insoluble in hydrochloric acid).

Oleum Caryophylli. Oil of Clove, *official.*—(Syn., Ol. Caryoph., Clove Oil, Oil of Cloves; Fr. Essence de Girofle; Ger. Oleum Caryophyllorum, Nelkenöl, Eugenol.) This volatile oil distilled from the flower-buds (clove) with water or steam, and usually 3 p. c. of sodium chloride, to raise the ebullition-point possibly to 109.5° C.; (229° F.), is a colorless, pale yellow liquid, darker and thicker by age and exposure, characteristic odor and taste of clove, soluble in 2 vols. of 70 p. c., alcohol, lævorotatory, sp. gr. 1.038–1.060; contains at least 82 (80–90) p. c. of eugenol, $C_{10}H_{12}O_2$ (heavy portion—phenol), caryophyllene, $C_{15}H_{24}$ (light portion, polymeric with terpene, $C_{10}H_{16}$, sp. gr. 0.918—sesquiterpene), also 2–3 p. c. of eugenol acetate; methyl-amylketone (gives odor), vanillin, furfurol (causes oil to darken), methyl alcohol. *Tests:* 1. Shake oil (1) with hot distilled water (20)—shows only slight acid reaction; filtrate with few drops of ferric chloride T. S.—transient grayish-green color, but not blue or violet (abs. of phenol). Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

Eugenol. Eugenol, $C_{10}H_{12}O_2$, *official.*—(Syn., Eugenolum, Eugenin, Caryophyllic Acid, Eugenic Acid, Allylguaiacol, Ethylmethyl-pyrocatechol, Para-oxy-metamethoxyallyl benzol.) This unsaturated, aromatic phenol (found also in oils of bay, canella, camphor, cinnamon (Ceylon), sassafras, pimento, Massoi bark) is obtained by shaking oil of clove with excess of 5–10 p. c. solution of sodium hydroxide in a separator, drawing off resulting solution of eugenol sodium, washing aqueous liquid with ether, decomposing with diluted sulphuric acid, washing separated eugenol with sodium carbonate solution (to remove adhering acid), distilling with steam or in vacuo. It is a colorless, pale yellow, thin liquid, strongly aromatic odor of clove; pungent, spicy taste; darker and thicker on exposure to air; miscible with alcohol, chloroform, ether, fixed oils, soluble in 2 volumes of 70 p. c. alcohol; mixed with hot distilled water (1 in 20) very slightly acid, sp. gr. 1.067, boils at 253° C. (488° F.); optically inactive and strongly refractive. *Tests:* 1. Dissolve 1 Ml. (Cc.) in sodium hydroxide T. S. (12), add distilled water (18)—clear solution, turbid on exposure to air; 5 Ml. (Cc.) of cold, clear filtrate, + a drop of ferric chloride T. S.—transient, grayish-green, not blue or violet (abs. of phenol); upon eugenol alone the value of oil of clove depends. Should be kept cool, dark, in well-closed containers. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

Caryophyllin, $C_{10}H_{16}O$.—Obtained by treating ethereal extract of clove with water, filtering and treating the resulting precipitate with ammonia to purify; occurs in tasteless, inodorous silky needles, soluble in ether, slowly in alcohol, colored red with sulphuric acid, and by oxidation with nitric acid yields crystals of caryophyllinic acid, $C_{20}H_{32}O_6$.

PREPARATIONS.—1. *Tinctura Lavandulæ Composita*, $\frac{1}{2}$ p. c. 2. *Tinctura Rhei Aromatica*, 4 p. c.

Unoff. Preps.: Infusum Caryophylli (Br.), 2.5 p. c., dose, ℥ss–1 (15–30 Ml. (Cc.)). *Rubefacient Spice Powder*, 30 p. c., Saigon cinnamon 30, Jamaica ginger 20, capsicum 20. *Tincture*, 25 p. c. (Fr. alcoholic), dose, ʒss–1 (2–4 Ml. (Cc.)).

PROPERTIES.—Stimulant, stomachic, carminative, antiemetic, aromatic, antispasmodic, rubefacient, germicide, antiseptic. Increases circulation, temperature, digestion, nutrition; excreted by kidneys, skin, liver, bronchial mucous membrane, stimulating and disinfecting these emunctories.

USES.—Nausea, vomiting, flatulence, colic, indigestion, condiment, corrective; externally in rheumatism, neuralgia, toothache (oil + oil of peppermint + hydrated chloral), in liniments, etc.

Allied Plant:

1. *Eugenia Jambola'na, Jambul, Java Plum.*—E. Indies. Large tree producing edible fruit; all parts astringent, but seed and bark also arrest formation of sugar in diabetes; seed 1.2 Cm. ($\frac{1}{2}'$) long, a third as thick, oval, one end truncate, blackish-gray, hard, heavy, little odor and taste; capsules, fluidextract. Dose, gr. 5–10 (.3–.6 Gm.).

PIMENTA. PIMENTA.

Oleum Pimentæ. Oil of Pimenta, *official.*

Pimenta officinalis, *Lindlay.* }
(Pimenta Pimenta, *(Linné) Lyons.)* } A volatile oil, distilled from the fruit.

Habitat. C. and S. America, W. Indies, Jamaica, Venezuela; cultivated.

Syn. Allspice, Pimento or Clove (Jamaica) Pepper, Semen or Fructus Amomi, Piper Jamaicense; Ol. Piment., Pimento Oil, Oil of Allspice; Fr. Piment de la Jamaïque, Toute épice, Essence de Piment de la Jamaïque; Ger. Nelkenpfeffer, Englisches Gewürz, Neugewürz; Pimentöl Nelkenpfefferöl.

Pi-men′ta. L. fr. Sp. *pimienta*, pepper—*i. e.*, first European name for *Allspice;* L. *pigmentum*, spice.

Of-fi-ci-na′lis. L. see etymology of (*Asagræa*) *officinalis*, page 102.

All′spice—all + spice—i. e., supposed to combine cinnamon, nutmeg, and clove odor—at one time all of the important spices.

Plant.—Handsome evergreen tree 9–12 M. (30–40°) high, slender trunk, bark smooth, gray; young branches quadrangular; leaves 10–15 Cm. (4–6′) long, bright green, entire, oval-oblong, obtuse, pellucid-punctate beneath, midrib prominent; flowers small, white, racemes. Fruit, 5–7 Mm. ($\frac{1}{5}$–$\frac{1}{4}$′) thick, subglobular, crowned with short, 4-parted calyx and short style, or their remnants, dark brown, pericarp brittle, 1 Mm. ($\frac{1}{25}$′) thick, glandular-punctate, 2-celled, each cell 1-seeded; seed reddish-brown, plano-convex, slightly reniform; odor and taste peculiarly, agreeably aromatic; pericarp and embryo contain oil-cells, the embryo also starch grains. Solvents: alcohol extracts the virtues; water absorbs the flavor, and if hot, some constituents. Dose, gr. 5–30 (.3–2 Gm.).

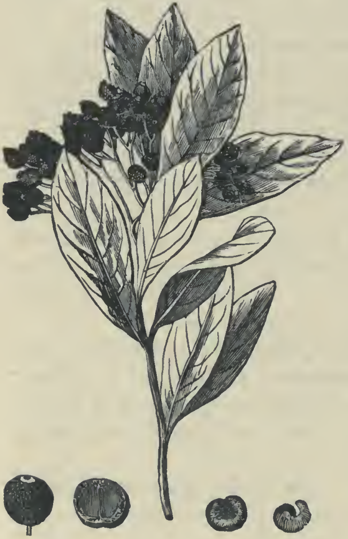


Fig. 277.—*Pimenta officinalis* (*Pimenta*).

Adulterations.—Fruit: Rare—colored with ochre, ferric oxide, spice bush berries; Powder: Bean and pea meal, mustard shells; Oil: Phenol, oil of turpentine, etc.

Commercial.—Forests are cleared of all other trees, leaving only the allspice, which bear when 3–4 years old. The fruit (drupe) if allowed to ripen fully becomes purplish-black, fleshy, sweet, and devoid of aromatic properties, consequently it is collected when full-grown, yet green—the small twigs bearing the bunches or clusters being broken off and dried in ovens (kiln-dried allspice), or in the sun 10–12 days, which, in spite of yielding a better product, is attended with risk, since they must be housed at night and at other times protected from damp and rainy weather.

Constituents.—Volatile oil 3–4 p. c., resin, fixed oil 6–8 p. c., tannin, sugar, gum, ash 4 p. c.

Oleum Pimentæ. Oil of Pimenta.—This volatile oil distilled from the fruit (with water or steam), yielding not less than 65 p. c., by volume, of eugenol, comes over in two fractions mixed together, one light, the other heavy; it is a colorless, yellow or reddish liquid, darker with age, characteristic odor and taste of allspice, soluble (clear) in equal volume of 90 p. c. alcohol, in 2 vols. of 70 p. c. alcohol, sp. gr. 1.033, lævorotatory; contains at least 65 p. c. of eugenol, $C_{10}H_{12}O_2$, probably a sesquiterpene. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

PREPARATIONS.—(Unoff.): *Aqua Pimentæ*, 25 Gm. + water 1,000 Ml. (Cc.)—distil 500 Ml. (Cc.). *Infusion*, 5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)).

PROPERTIES.—Similar to clove; stomachic, stimulant, carminative, condiment, improves digestion, increases salivary secretion.

USES.—Flatulence, nausea, intestinal colic, corrective to griping purgatives and nauseous tasted medicines; may combine with Burgundy pitch or lead plaster for rheumatism, neuralgia, chilblains, etc., causing local warmth, smarting, redness.

The dried, nearly ripe fruit, official 1820–1910.

Allied Plant:

1. *Myr'cia* (*Pimenta*) *ac'ris*, *Bayberry*.—The volatile oil, official 1880–1900; W. Indies, Jamaica; cultivated. Tree beautiful, fragrant, 9–12 M. (30–40°) high, leaves 5–8 Cm. (2–3′) long, ovate, coriaceous, pellucid-punctate, exhaling aroma when bruised similar to clove (volatile oil), flowers small, white with red tinge, fruit globular berry, size of a pea, blackish, resembling allspice; contains (leaves) volatile oil, tannin. Oil obtained by distilling leaves with water or steam; it is an aromatic (clove-like), yellowish, pungent liquid, containing eugenol, chavicol, myrcene, phellandrene, citral, etc. Astringent, tonic, stimulant, perfume; nervous headache, faintness, chafing, hair-washes, perfumery; Spiritus Myricæ Compositus—bay rum, may be made by mixing oil of myrcia 8 Ml. (Cc.), oil of orange .5, oil of pimenta .5, alcohol 610, water q. s. 1,000 Ml. (Cc.), or better grades by distilling leaves with St. Croix rum.

EUCALYPTUS. EUCALYPTUS.

Eucalyptus globulus, *Labillardière.* { The dried leaves, collected from older parts of the tree, with not more than 3 p. c. of stems, fruits, foreign matter.

Habitat. Australia (Tasmania, Victoria); cultivated in subtropics, Europe, N. Africa, S. United States (California, Florida, etc.; rich valleys, moist slopes of wooded hills.

Syn. Eucalypt., Blue Gum Leaves, Gum Tree (Wood), Fever Tree of Australia, Blue Gum-tree, Woolly Butt, Iron Bark Tree; Fr. Feuilles d'Eucalyptus; Ger. Eucalyptus-blätter.

Eu-ca-lyp'tus. L. fr. Gr. *εὐ*, well, good, + *καλυπτός*, covered—*i. e.*, the calyx-limb covers the flower bud before expansion and afterward, at anthesis, falls off in the shape of a lid or cover—the outer operculum of the bud (not the inner of united petals).

Glob'u-lus. L. *globulus, globulosus*, a little ball, globular—*i. e.*, the thick button-like form of the fruit.

PLANT.—Rapid-growing tree, 60–90 M. (200–300°) high, 3–6 M. (10–20°) thick (the largest being 141 M. (470°) high, 27 M. (87°) in circumference—*E. amygdalina*); bark ash-color; flowers Nov.–Dec., hermaphrodite, pedunculate, pinkish-white, buds very glaucous, consisting of calyx-tube covered by conical lid (operculum) of calyx-limb and united petals, fruit capsules, 18 Mm. ($\frac{3}{4}'$) broad, half-globular, 4–5-ribbed, dehiscing at apex, many-seeded. LEAVES, lanceolately scythe-shaped, 8–30 Cm. (3–12′) long, 2–7.5 Cm. ($\frac{4}{5}$–3′) broad, acute, acuminate, base unequal, obtuse, rounded, connected with a twisted petiole, 5–35 Mm. ($\frac{1}{5}$–1$\frac{2}{5}'$) long, margins slightly uneven, revolute; coriaceous, both surfaces pale yellowish-green, glaucous, glabrous, glandular-punctate and with numerous small, circular, brown dots of cork; veins of the first order anastomosing, forming a line nearly parallel with the margin, stomata deeply depressed (level or elevated in spurious leaves); odor slightly aromatic; taste aromatic, bitter, cooling. POWDER, greenish-gray; microscopically—fragments of palisade cells with oil-secretion reservoirs and yellow oily content, calcium oxalate crystals (rosette aggregates), portions of fibro-vascular bundles, bast-fibres. *Solvents:* diluted alcohol; boiling water. Dose, gr. 15–60 (1–4 Gm.).

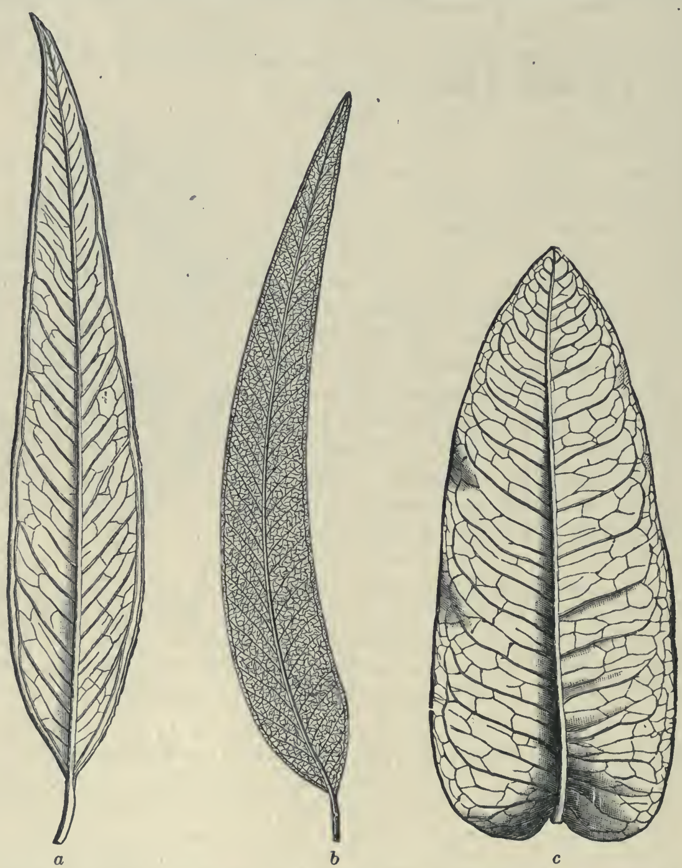


FIG. 278.—*Eucalyptus globulus: a, b,* leaves from old twig; *c,* from young twig.

Adulterations.—Leaves: Various leaves having stomata level with leaf-surface, not deeply depressed as in genuine; Powder: Should not reveal epidermal fragments with guard-cells of stomata visible upon vertical view, nor should any fragments, without stomata, exhibit wavy epidermal cells upon vertical view; Oil: Oils of various species of Eucalyptus containing much phellandrene, castor oil 12–20 p. c.

Commercial.—The blue-gum tree of Tasmania (exuding blue-gum), discovered by Labillardière, French botanist, 1792, and introduced into Europe, 1856, is sensitive to cold, but under favorable conditions attains the height of 15 M. (50°) in 6 years; there are 135 species, the wood of many being hard, resinous and valuable. The aborigines knew something of its virtues, while the Spaniards used it for fever and ague, 1867, but Drs. Brunel and Ramel extolled and proved its antiperiodic properties, 1868–1869. Leaves are picked, dried carefully, and enter trade very little broken, those that are ovate, equilateral, thin and sessile, "junior," being rejected; only the Australian variety should be used, as they vary less in the yield of oil; however, most of our supply comes from California.

Constituents.—Volatile oil 6 p. c., tannin, cerylic alcohol, 3 resins (1 acid, crystallizable), eucalyptic acid.

Oleum Eucalypti. Oil of Eucalyptus, *official.*—(Syn., Ol. Eucalypt., Eucalyptus Oil; Fr. Essence d'Eucalyptus; Ger. Eucalyptusöl.) This volatile oil, distilled from the fresh leaves (old leaves containing very little oil), is a colorless, pale yellow liquid, characteristic, aromatic, somewhat camphoraceous odor, pungent, spicy, cooling taste, soluble in 4 vols. of 70 p. c. alcohol, sp. gr. 0.915, dextrorotatory; contains at least 70 p. c. of eucalyptol (cineol), $C_{10}H_{18}O$, 20 p. c. of cymene, $C_{10}H_{14}$, eudesmol, $C_{10}H_{16}O$, phellandrene, $C_{10}H_{16}$, eucalyptene, $C_{10}H_{18}$, terpene—*d*-pinene (small amount), $C_{10}H_{14}$, also a little valeric, butyric and capronic aldehydes; with hydrochloric acid yields eucalypteol (eucalyptene hydrochloride), $C_{10}H_{16}.2HCl$, in white hygroscopic, aromatic crystals; with phosphoric oxide yields eucalyptolene, thickish liquid. *Tests:* 1. Mix oil (2) with glacial acetic acid (4), add saturated solution of sodium nitrite (3), stir gently—no crystals of phellandrene nitrite (abs. of other eucalyptus oils containing much phellandrene). *Impurities:* castor oil 12–20 p. c., etc. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏v–15 (.3–1 Ml. (Cc.)).

Eucalyptol. Eucalyptol, $C_{10}H_{18}O$, *official.*—(Syn., Cineol, Cajuputol; Fr. Eucalyptol, Oxyde de Terpilène; Ger. Eucalyptus Kampfer.) This organic compound (found also in cajuput, canella, curcuma, laurus, mentha, rosemary, salvia, santonica) is the most valuable constituent of eucalyptus oil, being a neutral substance with a definite chemical composition, which is not true of the oil, and may be obtained by distilling the volatile oil and placing in a freezing mixture that portion coming over between 150–175° C. (302–347° F.), from which it crystallizes in long, colorless needles; a more satisfactory method is to treat the oil with hydrochloric acid gas or phosphoric acid, add warm water to separate eucalyptol on the surface, then wash with dilute alkali solution and distil. It is a colorless liquid, characteristic, aromatic, distinctly camphoraceous odor, pungent, spicy, cooling taste; slightly soluble in water, miscible with alcohol, chloroform, ether, glacial acetic acid, fixed or volatile oils, sp. gr. 0.922, boils at 176° C. (349° F.), congeals at 0° C. (32° F.). *Tests:* 1. Optically inactive (dist. from oil of eucalyptus, many other volatile oils). 2. Place 1 Ml. (Cc.) in freezing mixture, add phosphoric acid (1)—solid, white, crystalline mass (cineol-phosphoric acid), + warm water—eucalyptol separates. 3. Shake 5 Ml. (Cc.) with sodium hydroxide T. S. (5)—eucalyptol volume not diminished (abs. of saponifiable oils). 4. Alcoholic solution (1 in 10) neutral; of this 5 Ml. (Cc.), + a drop of ferric chloride T. S.—not brown or violet (abs. of phenols). *Impurities:* Oil of eucalyptus, volatile oils, saponifiable oils, phenols. Should be kept cool, dark, in well-closed containers. Dose, ♏v–15 (.3–1 Ml. (Cc.).

Preparations.—1. *Fluidextractum Eucalypti.* Fluidextract of Eucalyptus. (Syn., Fldext. Eucalypt., Fluid Extract of Eucalyptus; Fr. Extrait fluide d'Eucalyptus; Ger. Eucalyptusfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: 75 p. c. alcohol, reserve first 80 Ml. (Cc.). Dose, ♏xv–60 (1–4 Ml. (Cc.)).

Unoff. Preps.: Leaves: *Extract,* dose, gr. 2–10 (.13–.6 Gm.). *Infusion,* dose, ℥j–2 (30–60 Ml. (Cc.)). *Tincture,* 15 p. c., dose, ʒss–2 (2–8 Ml. (Cc.)). Oil: *Unguentum Eucalypti* (Br.), 10 p. c. *Water* (*Aqua*), dose, ʒj–4 (4–15 Ml. (Cc.)). Eucalyptol: *Petroxolin,* 20 p. c. + liquid petroxolin 80. *Spray* (*Nebula*), 5 p. c. + light liquid petrolatum 95.

Properties.—Antiperiodic, antipyretic, expectorant, stimulant, astringent, antiseptic, disinfectant, diaphoretic; like quinine arrests white blood-corpuscle movement; increases flow of saliva, gastric juice, heart action, appetite, digestion; large doses produce indigestion, diarrhœa, vomiting, muscular weakness, low temperature, renal and cerebral congestion, paralyzed respiration, death; destroys low forms of life, reduces arterial tension and enlarged spleen. It antagonizes malaria thus: 1, its dead leaves elevate the low moist soil; 2, being a rapid grower, its leaves, roots, etc., absorb much malarial soil-water and noxious germs, thus causing the surrounding country to become dry, thereby purifying the atmosphere; 3, its enormous foliage protects large areas from direct sun-rays which favor the generation of animalculæ; 4, its aseptic emanations purify the air. Owing to these properties it is cultivated largely in malarial districts, to render them sanitative, and to reclaim infected localities, as portions of Australia, Jamaica, Roman Campagna, etc. It is eliminated by skin, bronchia, kidneys, lungs, with more or less irritation, imparting odor to breath and urine.

Uses.—Intermittent fever, genito-urinary and pulmonary catarrh, chronic bronchitis, mucous membrane affections, asthma (smoked with stramonium). Used when quinine is contra-indicated, intermittents, typhoid, scarlatina, whooping-cough, cancer, hemorrhages; externally

—as antiseptic in ulcers, gonorrhœa, spongy gums, gleet, deodorizer in diseases with disagreeable odor, preventive of putrefaction; spray beneficial in diphtheria, gangrene of lungs, fetid bronchitis. Tincture (1) added to codliver oil (100) removes fishy flavor; the leaves deter moths entering woolen cloth; bark used for tanning, dyeing.

Incompatibles: Agents promoting waste, alkalies, mineral acids and salts.

Synergists: Aromatic bitters, antispasmodics, copaiba, cubeb, oil of turpentine, etc.

Allied Plants:

1, *Eucalyptus amygdali'na, Peppermint Tree.*—Australia; has peppermint odor, and being more accessible, its foliage is much used for obtaining *eucalyptus kino,* and volatile oil, which oil is claimed to be almost entirely without eucalyptol; 2, *E. dumo'sa;* 3, *E. obli'qua* (Stringy-bark tree); 4, *E. Leucox'ylon* (*Siderox'ylon*) (Iron-bark tree), and 5, *E. oleo'sa* (Mallee tree). The yield of these in volatile oil is varying, but Bosisto obtained the following results, which are only of comparative interest, thus for every 100 pounds (45.5 Kg.) of each

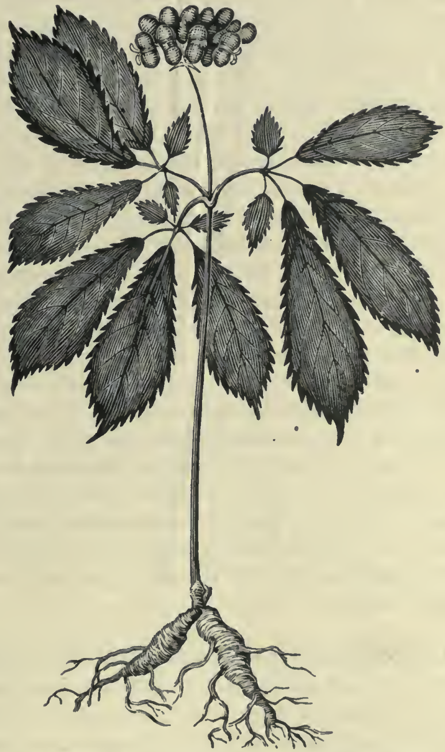


FIG. 279.—*Panax* (*Aralia*) *quinquefolium.*

variety: No. 1 gave 50 ounces (1.5 L.); No. 2, 30 ounces (.9 L.); No. 3, 8 ounces (.2 L.); No. 4, 16 ounces (.5 L.); No. 5, 20 ounces (.6 L.), while the official yielded 12 ounces (.3 L.).

6. *Ara'lia spino'sa, Hercules' Club, Prickly Elder.*—Araliaceæ. The bark, official 1820–1880; N. America. Prickly tree, 3–9 M. (10–30°) high, leaflets crowded at summit; flowers white; bark in quills, curves, gray, prickly, inside yellowish, aromatic, acrid; contains araliin, volatile oil, resin. Used as stimulant, diaphoretic, demulcent (emetic, cathartic), for rheumatism, skin eruptions, syphilis, colic, dyspepsia, toothache, vomiting, nervousness; externally antidote to rattlesnake-bites; in infusion, decoction, tincture, masticatory. Dose, gr. 30–60 (2–4 Gm.).

7. *A. nudicau'lis, Wild, Virginian,* or *False Sarsaparilla.*—The root (rhizome), official 1820–1880; N. America. Small shrub, stem scarcely above ground, leaf single, petiole .3 M. (1°) high; leaflets ovate, serrate, flowers greenish. Root .3 M. (1°) long, 5 Mm. (⅕′) thick, annulate, brownish-gray, inside whitish, spongy pith, aromatic odor and taste; contains volatile oil, resin, starch. Used as stimulant, diaphoretic, alterative—like sarsaparilla, in infusion, decoction. Dose, gr. 30–60 (2–4 Gm.). *A. racemo'sa, American Spikenard, Spignet,* dried rhizome and roots; stem herbaceous, branched, 1 M. (40′) high, leaflets heart-ovate, serrate; rhizome 12 Cm. (5′) long, 5 Cm. (2′) thick, pale brown, internally whitish, nodes approximate, often cut longitudinally, roots numerous, .5–.7 M. (20–30′) long, 5–25 Mm. (⅕–1′) thick; stronger aromatic odor and mucilaginous, pungent taste than preceding—otherwise similar; fluidextract (67 p. c. alcohol).

8. *Pa'nax quinquefo'lium* (*Aralia quinquefolia*), *Panax, Ginseng.*—The root, official 1840–1880; N. America. Small shrub, .3 M. (1°) high, smooth, leaflets 5's, serrate; flowers yellowish, fruit scarlet; root 5–12.5 Cm. (2–5′) long, fusiform, annulate, branched, brownish-yellow, wood yellowish, sweetish, aromatic; contains panaquilon, resin, volatile oil, starch, gum. Used as stimulant, demulcent, stomachic, in infusion, decoction, tincture. The *Chinese Ginseng* (*Aralia Gin'seng*) is very similar to this, slightly larger. Used natively as nervine, aphrodisiac. Dose, ʒss–2 (2–8 Gm.).

53. UMBELLIFERÆ. Parsley (Carrot) Family.

Um-bel-lif'e-re. L. *Umbellifer-æ—umbella,* umbel, + *ferre,* to bear —*i. e.,* flowers borne in umbels. Herbs, shrubs. Distinguished by possessing aromatic, stimulant volatile oils; flowers in umbels; stems hollow; leaves usually compound; fruit cremocarp, with vittæ (oil-tubes), indehiscent; calyx adnate to ovary; petals and stamens 5, inserted on fleshy epigynous disk; ovary 2-celled, inferior; seeds 1 in each carpel, albumin horny; temperate climates; aromatic, carminative, stimulant, tonic (vol. oil), narcotic, poisonous (acrid juice), antispasmodic (gum-resin).

Genera: **1. Petroselinum. 2. Carum. 3. Pimpinella. 4. Fœniculum. 5. Coriandrum. 6. Ferula.**

UMBELLIFERÆ

PETROSELINUM. PARSLEY FRUIT.

Petroselinum sativum, *Hoffman.*
(**Petroselinum Petroselinum,** (*Linné*) *Lyons*).

The dried ripe fruit, with not more than 5 p. c. of foreign seeds, other matter.

Habitat. S. Europe, Asia Minor, Sardinia, United States, California; cultivated in gardens universally.

Syn. Petrosel., Parsley Seed, Perceley, Persel, Parsil, Parcel, Apium, Garden (Common, Rock) Parsley; Fr. Persil; Ger. Petersilie, Petersilge.

Pet-ro-se-li′num. L. fr. Gr. *πέτρα*, rock, + *σέλινον*, parsley—rock parsley —*i. e.*, its original favorite habitat.

Sa-ti′vum. L. *sativus*, sown, cultivated—*i. e.*, kind used, in contradistinction to the wild-grown.

Plant.—Annual herb, .6–1.2 M. (2–4°) high, stem furrowed, jointed, branched; root biennial, conical, 15 Cm. (6′) long, 12 Mm. ($\frac{1}{2}$′) thick, annulate, yellowish; leaves—radical and cauline, 3-pinnate; flowers small, yellowish, umbels, involucre. Fruit, cremocarp, ovoid-crescent-shaped, 2–3 Mm. ($\frac{1}{12}$–$\frac{1}{8}$′) long, 1 Mm. ($\frac{1}{25}$′) broad, grayish-brown, brownish on aging, mericarps 2, usually separate, each with 5 filiform, prominent ribs, alternating with coarsely roughened furrows; in transverse section nearly hemispherical, commissural surface with 2 vittæ, dorsal usually 1 vitta, occasionally 2 vittæ in the grooves between primary ribs; endosperm large, oily, enclosing small embryo; odor and taste characteristic, aromatic, especially when bruised. Powder, grayish-brown; microscopically—mostly of large, irregular fragments, cells of endosperm with aleurone grains, each containing a rosette aggregate of calcium oxalate, fragments with vittæ, cells of pericarp, tracheæ, and sclerenchymatous fibres. Should be kept dark, in tightly-closed containers. *Solvents:* alcohol; water partially. Dose, gr. 10–30 (.6–2 Gm.).

Constituents.—Volatile oil 1.5–3 p. c., Apiol, Resin, fixed oil 12 p. c., cariol, apiin, apiolin, tannin, mucilage, ash 7 p. c.

Volatile Oil.—Obtained by distillation; thick, greenish-yellow, sp. gr. 1.050, lævorotatory; contains apiol (camphor—most important), terpene, probably pinene, $C_{10}H_{16}$.

Apiol, $C_{12}H_{14}O_4$.—Obtained by freezing the volatile oil, some being so rich as to become semifluid at ordinary temperature; or by exhausting fruit with benzin, evaporating spontaneously, dissolving from residue the apiol with alcohol (leaving fat, wax), evaporating. It is in white, brittle, needle-shaped crystals, melting at 30° C. (86° F.) into non-volatile liquid (oleoresin), not modified by alkalies, soluble in alcohol, chloroform, ether; with potassium permanganate converted into apiolic acid, $C_{10}H_{10}O_6$, boiled with alcoholic solution of potassium hydroxide changed into isoapiol, melting at 56° C. (132° F.); odor parsley-like; taste aromatic, burning. Commercial liquid apiol obtained with alcohol, reclaiming same and allowing wax to deposit, is a greenish oily liquid, sp. gr. 1.050, and should neither be called nor dispensed as apiol. Dose, gr. 3–8 (.2–.5 Gm.).

Preparations.—1. *Oleoresina Petroselini.* Oleoresin of Parsley Fruit. (Syn., Oleores. Petrosel., Liquid Apiol; Fr. Oléorésine de Persil; Ger. Ætherisches Petersilieextrakt.)

Manufacture: Percolate slowly, in a covered glass percolator, 100 Gm. with ether, added in successive portions, until exhausted, reclaim most of the ether on water-bath, transfer residue to a dish, allow remaining ether to evaporate spontaneously in a warm place, stirring frequently, allow to stand without agitation 4–5 days, decant clear liquid portion from any solid residue. Should be kept in well-stoppered bottles. Dose, ♏v–15 (.3–1 Ml. (Cc.)).

Unoff. Preps.: Fluidextract, dose ♏x–30 (.6–2 Ml. (Cc.)). *Infusion,* 5 p. c., dose, ʒj–8 (4–30 Ml. (Cc.)).

Properties.—Diuretic, stimulant, emmenagogue, carminative, antiperiodic, insecticide, germicide.

Uses.—Nephritis, cystitis, dropsy, amenorrhœa, dysmenorrhœa (beginning 3–4 days before the molimen); fresh juice in intermittents.

The dried roots (petroselini radix), similar in strength and action, also employed medicinally; fluidextract (67 p. c. alcohol). Dose, ʒss–1 (2–4 Ml. (Cc.)).

Allied Plants:

1. *Ap'ium (Carum—Petroselinum) grave'olens, Apii Fructus, Celery (Fruit).*—S. Europe, cultivated. The ripe fruit—1 Mm. ($\frac{1}{25}'$) long, ovate, flattened, brown, smooth, mericarps 2, 5 ribs, 12 vittæ; contains volatile oil, fixed oil; root, fusiform, white, when wild poisonous; under cultivation, harmless; blanched stalks popular as a salad. Used as carminative, stimulant, flavoring (in infusion, juice); bronchitis, intermittents, contusions, swollen glands. Dose, gr. 15–30 (1–2 Gm.); fluidextract (alcohol).

2. *Eryn'gium aquat'icum (yuccæfo'lium), Button Snakeroot.*—The root, official 1820–1860; United States. Plant .6–1.8 M. (2–6°) high, leaves rigid, pointed, .3–1 M. (1–3°) long, bristly; flowers white; root tuberous, 6–12 Mm. ($\frac{1}{4}$–$\frac{1}{2}'$) long, branched, cup-shaped scars, central pith, aromatic; taste sweet, acrid, aromatic, resembles parsnip; contains volatile oil. Used as diaphoretic, expectorant, sialagogue, emetic; dropsy, gravel, jaundice, substitute for senega; in infusion, decoction, tincture. Dose, ʒss–1 (2–4 Gm.).

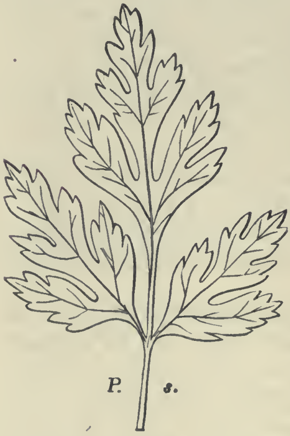


Fig. 280.—*Apium (Carum—Petroselinum) graveolens:* pinnate leaf.

3. *Coni'um macula'tum, Hemlock, Poison Hemlock.*—The full-grown but unripe fruit, carefully dried, preserved, and containing .5 p. c.

of coniine, official 1820–1910; Europe, Asia, N. Africa; naturalized in N. and S. America, waste places. Large branching herb, 2–2.5 M. (6–8°) high, stem furrowed, hollow, smooth, green, mottled with port-wine-colored spots; root biennial, fusiform, 15 Mm. ($\frac{3}{5}'$) thick, exuding milky juice when cut; flowers white, small umbels; leaves bi-pinnate, 15–30 Cm. (6–12′) long, incised, dentate, mucronate, grayish-green on drying. Fruit, cremocarp, ovate, greenish-gray, 2 mericarps usually separated, each 3 Mm. ($\frac{1}{8}'$) long, 1.5 Mm. ($\frac{1}{16}'$) broad, ovate, convex side with 5 pale yellow crenate ribs, no vittæ, flat surface with longitudinal groove; odor of mice urine, especially with alkali; taste characteristic, disagreeable, bitter; solvent: alcohol; contains coniine (conine—liquid) .5–1.5 p. c., methylconiine, conhydrine, pseudoconhydrine, volatile oil, fixed oil, coniic acid. Sedative, narcotic, anodyne, soporific, antispasmodic, anaphrodisiac; depresses all motor nerves, beginning in peripheries, thence to spinal cord, etc., causing motor paralysis without loss of sensation; spasmodic chorea, whooping-cough, melancholia, neuralgia, delirium tremens, tetanus, asthma, epilepsy,

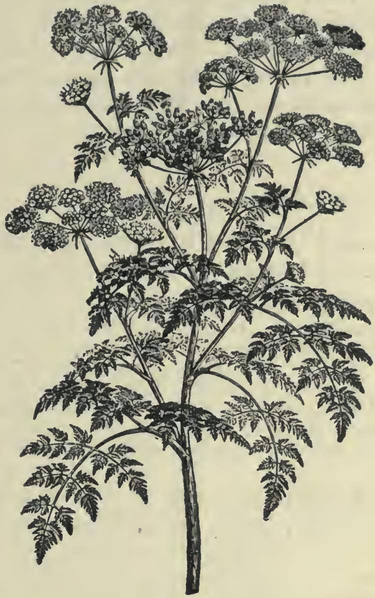


FIG. 281.—*Conium maculatum.*

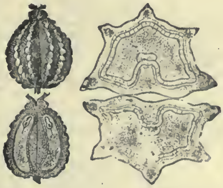


FIG. 282.—Conium: fruit and longitudinal section magnified 3 diam.; transverse section magnified 8 diam.

pneumonia; scrofulous glandular sores, affections of mammary glands, to check milk secretion, etc. *Poisoning:* Vomiting, fatigue, heaviness of legs, numbness, drooped eyelids, mydriasis, vertigo, impaired speech, slow pulse, paralysis of voluntary muscles, loss of speech, and vision, death from paralysis of respiratory muscles—emetics, lavage, tannin, strychnine, diffusible stimulants, atropine, warmth, epispastics, artificial respiration. Dose, gr. 1–5 (.06–.3 Gm.); extract (diluted alcohol + .3 p. c. of diluted hydrochloric acid), gr. $\frac{1}{2}$–2 (.03–.13 Gm.); fluidextract (diluted alcohol + 2 p. c. of acetic acid), ♏j–5 (.06–.3 Ml. (Cc.)); ointment, tincture.

CARUM. CARAWAY.

Carum Carvi (Carui), *Linné.* { The dried fruit, with not more than 3 p. c. of other fruits, seeds, foreign matter.

Habitat. C. and W. Asia, Himalayas, Caucasus, Europe, Siberia; cultivated in England, Norway, Russia, Germany, Holland, Morocco, United States.

Syn. Carawayseed, Caraway Seed (Fruit), Carvies; Br. Carui Fructus; Fr. Carui, Carvi, Cumin des Prés; Ger. Fructus Carvi, Kümmel, Gemeiner Kümmel.

Ca'rum. L. *careum*, fr. Gr. *κάρον*, after Caria, in Asia Minor—*i. e.*, its original habitat. *Carui* was the name used by medieval pharmacists for the drug.

Car'vi. L. for *carvy*, *carvey*. Ar. *karawya*, Eng. caraway. Here frequently the word *Carui* is used, thus assimilating L. gen., as though for *Carui Semina*.

PLANT.—Biennial herb; stem .3–1 M. (1–3°) high, hollow; leaves bi- or tripinnate, deeply incised; flowers May–June, small, white, no involucre; root fleshy, fusiform, white. FRUIT, cremocarp, oblong, brownish, 2-seeded; mericarps 2, usually separate, crescent-shaped, 3–7 Mm. ($\frac{1}{8}$–$\frac{1}{4}$′) long, 1.5 Mm. ($\frac{1}{16}$′) broad, each transversely nearly pentagonal with 5 yellowish filiform ribs; in transverse section dorsal surface with 4 vittæ (1 between each primary rib) and commissural surface with 2; endosperm large, oily, enclosing small embryo; odor and taste agreeably aromatic. POWDER, yellowish-brown; microscopically — fragments of endosperm cells with aleurone grains each containing a rosette aggregate of calcium oxalate, fragments with light yellow vittæ and inner epidermal cells of pericarp, fragments with tracheæ and sclerenchymatous fibres. Should be kept in tightly-closed containers, adding occasionally a few drops of chloroform or carbon tetrachloride to prevent insect attack. *Solvents:* alcohol; water partially. Dose, gr. 10–30 (.6–2 Gm.).

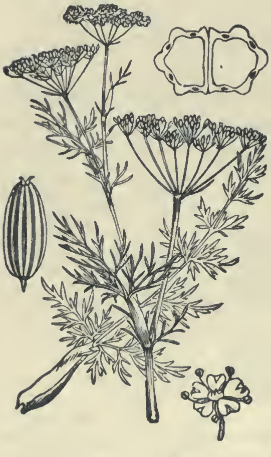


FIG. 283. — *Carum Carvi* (*Carui*): flower, fruit, and cross-section of fruit, enlarged.

Adulterations.—Allied and occasionally exhausted (drawn) fruits —having shriveled appearance; seeds of weeds—usually yielding starch in the powder; dirt—showing excess of ash.

Commercial.—Fruit ripens in the 2nd year, August, when the plant is cut down, dried, and thrashed on cloth. There are five varieties: 1, *Holland* (*Dutch*) finest; 2, *German;* 3, *English*, shortest; 4, *Mogador*, longest, lightest; 5, *American*, the result of home cultivation in gardens, being quite aromatic but smaller than the German, these two constituting nearly our total supply; yield 8–10 hundred-weight per acre; root, resembling that of parsnip, is employed as food in N. Europe.

Constituents.—Volatile oil 5–7 p. c., fixed oil, resin, tannin, sugar, gum, ash 5–8 p. c.; no starch.

Oleum Cari. Oil of Caraway, *official.*—(Syn., Ol. Cari., Caraway Oil; Br. Oleum Carui; Fr. Essence de Carvi; Ger. Oleum Carvi, Kummelöl, Carvon.) This volatile oil, obtained by steam distillation from the fruit, is a colorless, pale yellow liquid, characteristic odor and taste of caraway, soluble in 8 vols. of 80 p. c. alcohol, sp. gr. 0.905, dextrorotatory; contains at least 50 (50–65) p. c. of carvone, *d*-carvol, $C_{10}H_{14}O$ (ketone), 35–50 p. c. of carvene, $C_{10}H_{16}$ (terpene—chemically identical with citrene, hesperidene, *d*-limonene), and an alcohol, $C_{10}H_{17}OH$, etc. Carvone may be obtained by treating the oil with alcoholic solution of ammonium sulphide, decomposing the resulting crystals with potassium hydroxide; it is a viscid, yellowish, oily liquid, creosote odor and taste, closely related to menthol and myristicol, identical with thymol, cuminic alcohol and carvacrol, this latter being the product of distilling a mixture of caraway oil and potassium or sodium hydroxide (thus expelling carvene), decomposing residue with sulphuric acid, rectifying; useful in toothache, by inserting it into cavity. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏ij–5 (.13–.3 Ml. (Cc.)).

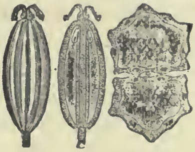


Fig. 284.—Carum: fruit and longitudinal section, 3 diam.; transverse section, 8 diam.

Preparations.—I. Fruit: 1. *Tinctura Cardamomi Composita*, 1 p. c. II. Oil: 1. *Spiritus Juniperi Compositus*, $\frac{1}{20}$ p. c.

Unoff. Preps.: I. Fruit: *Aqua Carui* (Br.), 100 Gm. + water 2,000 Ml. (Cc.), distil 1,000 Ml. (Cc.). *Fluidextract*, dose, ♏x-30 (.6–2 Ml. (Cc.)). *Infusion*, 5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)). II. Oil: *Spirit* (*Spiritus*).

Properties.—Carminative, stimulant, diuretic, stomachic.

Uses.—Flatulent colic, especially for infants, corrective to nauseous purgatives, flavoring, toothache (carvacrol), as a spice in cakes, bread, etc. The oil is used mostly, which acts externally like other essential oils, as an anæsthetic, etc.

ANISUM. ANISE.

Pimpinella Anisum, *Linné.* { The dried ripe fruit with not more than 3 p. c. of foreign seeds, other vegetable matter.

Habitat. W. Asia, Egypt, S. E. Europe; cultivated in S. Europe, United States, in gardens.

Syn. Anis., Aniseed, Aneys, Aunyle, Common Anise, Sweet Cumin, Semen Anisi; Br. Anisi Fructus; Fr. Anis, Anis vert, Graines d'Anise; Ger. Anis, Anissame.

Pim-pi-nel'la. L. Medieval name, altered, from *bipinnate* or *bipinnella*—*i. e.*, the pinnate leaves; lit. "the two-winged little plant."

An'i-sum. L. fr. Gr. *ἄνισον —ἄνηθον*, Ar, *anisum*, anise, dill—*i. e.*, classic name.

Plant.—Annual herb .3 M. (1°) high; dentate, pinnatifid; flowers white, small, umbels 8–14-rayed. Fruit, cremocarp, ovoid, pyriform compressed, grayish-green, slightly pubescent, 3–6 Mm. ($\frac{1}{8}-\frac{1}{4}'$) long, 2–3 Mm. ($\frac{1}{12}-\frac{1}{8}'$) broad; mericarps 2, usually cohering and attached to slender pedicel 2–12 Mm. ($\frac{1}{12}-\frac{1}{2}'$) long, each with 5 filiform ridges and 15–45 vittæ, summit with ring-like disk and 2 projecting styles; odor and taste agreeable, aromatic. Powder, yellowish-brown; microscopically—fragments of pericarp with vittæ, tracheæ, sclerenchymatous fibres of carpophore, cells of endosperm filled with aleurone grains, each usually enclosing a rosette aggregate crystal of calcium oxalate, 1-celled non-glandular hairs. *Tests:* 1. Heat 1 Gm. with potassium hydroxide T. S. (10)—no mouse-like odor (abs. of conium). 2. Incinerate—ash 9 p. c. *Solvents:* alcohol; boiling water partially. Dose, gr. 10–30 (.6–2 Gm.).

Adulterations.—Fruit: Earthy fragments, partly exhausted fruits, recognized by shriveled appearance, chiefly, however, with conium fruit (which resembles mostly the Russian anise), but odor and taste not aromatic—becoming mouse-like with solution potassium hydroxide even when 1 p. c. present; nonhairy; consisting usually of single smooth mericarps, grooved upon the face, 5-crenate ribs (ridges) with wrinkles between them, no vittæ; Powder: Star-anise recognized by its peculiar sclerotic cells, earthy matter sinking when stirred in strong brine; Oil: Spermaceti 5–35 p. c., wax, petroleum, fixed oils, oils of turpentine and fennel, camphor (to raise congealing-point), alcohol, fenchone (fennel stearoptene); the two first insoluble in cold alcohol, whereas oils and camphor are mostly soluble; camphors recognized—by odor; alcohol—by milkiness to water; star-anise oil is the same chemically, but has a slight distinguishing smell and taste, also lower congealing-point (1° C.; 34° F.).

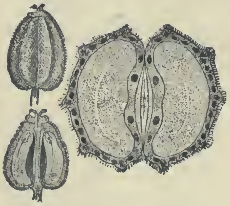


Fig. 285. — Anisum: fruit and longitudinal section magnified 3 diam.; transverse section magnified 8 diam.

Commercial.—Plant was known and cultivated by the Romans, while Theophrastus wrote of its aromatic properties; now grown mostly in Malta, Spain, Italy, S. Russia, Greece, Chile. There are four varieties: 1, *Spanish* (*Alicante*), small, best, preferred; 2, *German* (*French*), larger; 3, *Italian*, exported via Leghorn; 4, *Russian*, very short, resembling conium most; that cultivated at home supplies largely our market.

Constituents.—Volatile oil (anethol) 1–3 p. c., fixed oil 3–4 p. c., choline, resin, sugar, mucilage, malates, phosphates, ash 7 p. c.

Oleum Anisi. Oil of Anise. Oil of Star Anise, *official.*—(Syn., Ol. Anisi, Anise Oil; Fr. Essence d'Anis; Ger. Anisöl, Anethol.) This volatile oil, obtained by distilling the ripe fruit of anise or star anise (*Illicium verum*), is a colorless, pale yellow, strongly refractive liquid, characteristic odor and taste of anise, soluble with not more than slight cloudiness in 3 vols. of 90 p. c. alcohol; sp. gr. 0.983, increasing with age; contains a liquid body—terpenes and methyl-chavicol, $C_{10}H_{12}O$, and a stearoptene, anethol, $C_{10}H_{12}O$, 80–90 p. c., upon which the value depends, being converted by exposure or oxidation with nitric acid into anisic acid; star anise oil is the same chemically, containing anethol 80–90 p. c., *d*-pinene, *d*-phellandrene, and possibly safrol, but congeals at 1° C. (34° F.), while anise oil at 10–15° C. (50–59° F.). *Tests:* 1. Lævorotatory (abs. of oils of fennel, caraway, coriander—dextrorotatory). 2. Shake with water in graduated tube—volume should not diminish; drop into water—no milkiness unless agitated (abs. of alcohol). 3. Alcoholic solution neutral; with a drop of ferric chloride T. S.—no blue or brown color (abs. of phenols). *Impurities:* Heavy metals, oil of fennel, phenols. The label must indicate definitely its specific source, and if solid material has separated, carefully warm the oil until liquefied and thoroughly mix before dispensing. Should be kept dark, in well-stoppered, amber-colored bottles. Dose, ♏ij–5 (.13–.3 Ml. (Cc.)).

Anethol.—The methyl ether of para-propenyl phenol obtained from this and other oils by fractioning, chilling, crystallizing; practically identical with the oil.

Preparations.—Oil: 1. *Aqua Anisi.* Anise Water. (Syn., Aq. Anisi; Fr. Eau d'Anis; Ger. Aniswasser.)

Manufacture: $\frac{1}{5}$ p. c. Similar to Aquæ Aromaticæ—triturate oil .2 Ml. (Cc.) with purified talc 1.5 Gm., adding gradually recently boiled distilled water q. s. 100 Ml. (Cc.). Dose. ʒij–8 (8–30 Ml. (Cc.)).

2. *Spiritus Anisi.* Spirit of Anise. (Syn., Sp. Anisi, Essentia Anisi; Fr. Alcoolat (Esprit) d'Anis; Ger. Anisgeist.)

Manufacture: 10 p. c. Dissolve oil 10 Ml. (Cc.) in alcohol q. s. 100 Ml. (Cc.). Dose, ʒj–2 (4–8 Ml. (Cc.)).

3. *Fluidextractum Cascaræ Sagradæ Aromaticum,* $\frac{1}{4}$ p. c. 4. *Spiritus Aurantii Compositus,* $\frac{1}{2}$ p. c. 5. *Syrupus Sarsaparillæ Compositus,* $\frac{1}{50}$ p. c. 6. *Tinctura Opii Camphorata,* $\frac{2}{5}$ p. c.

Unoff. Preps.: Fruit: *Fluidextract,* dose, ♏x–30 (.6–2 Ml. (Cc.)). *Infusion,* 5 p. c., dose, ʒj–8 (4–30 Ml. (Cc.)). Anethol (Oil): *Elixir Anisi,* .35 p. c. + oil of fennel .05, spirit of bitter almond 1.2, alcohol

24, syrup 62.5, purified talc 2, distilled water q. s. 100. Dose, ♏xv–30 (1–2 Ml. (Cc.)).

PROPERTIES.—Aromatic stimulant and carminative, stomachic, once supposed a galactagogue, now doubted, although it does impart peculiar taste to secreting milk.

USES.—Flatulent colic, bronchitis, infantile catarrh. As a corrigent to griping cathartics, but here fennel is preferred; much used for flavoring food, confectionery, and in veterinary practice.

Allied Plants:

1. *Pimpinella Saxif'raga* and *S. mag'na;* dried rhizome and roots; light yellowish-brown, aromatic, sweetish, pungent; composition, properties and uses similar to anise. Dose, gr. 10–30 (.6–1 Gm.); tincture (67 p. c. alcohol) 20 p. c.

2. *Ane'thum* (*Peuced'anum*) *grave'olens, Dill Fruit, Dill Seed* (Br.).—S. Europe, Asia. Herb .6 M. (2°) high; leaves finely divided, glaucous; flowers yellow; fruit oblong, 4 Mm. ($\frac{1}{6}'$) long, brown, smooth, mericarps 2, flat-faced, each having 5 ribs, 6 vittæ, of which 3 are filiform, 2 lateral ones broadly winged, light colored, odor, and taste spicy, caraway-like; contains volatile oil 3–4 p. c., fixed oil. Used as carminative, stimulant, stomachic, condiment, flavoring; as a substitute for anise and caraway in flatulent colic, hiccough, indigestion. Dose, gr. 10–30 (.6–2 Gm.); volatile oil (oleum anethi, Br.), ♏ij–5 (.13–.3 Ml. (Cc.)); aqua anethi (Br.), 10 p. c., ℥ss–2 (15–60 Ml. (Cc.)).

FŒNICULUM. FENNEL.

Fœniculum vulgare, *Miller.* — The dried, ripe fruit of cultivated varieties, with not more than 4 p. c. of foreign matter.

Habitat. S. Europe, W. Asia; cultivated.

Syn. Fœnic., Fennel Seed (Fruit), Large, Giant, Sweet or Wild Fennel, Semen Fœniculi; Br. Fœniculi Fructus; Fr. Fenouil dulce, Fruits (Semences) de Fenouil; Ger. Fenchel (fructus, semen).

Fœ-nic'u-lum. L. fennel, dim. of *fenum* or *fœnum,* hay—*i. e.,* from a resemblance in odor.

Vul-ga're. L. *vulgaris,* common, ordinary—*i. e.,* kind growing wild, and in general use, originally not cultivated.

PLANT.—Large, perennial (biennial, annual) herb; stem .6–1.2 M. (2–4°) high, furrowed, green, glaucous, branched; rootstock thick; leaves twice pinnate, pinnæ very narrow, often only as wide as the thin petiole; flowers yellow, 15–20 in umbels, all parts with agreeable aromatic odor; sweet, aromatic taste. FRUIT, cremocarp, oblong, grayish-green; mericarps 2, usually separate, each broadly elliptical, more or less curved, 4–10 Mm. ($\frac{1}{6}$–$\frac{2}{5}'$) long, 1–3.5 Mm. ($\frac{1}{25}$–$\frac{1}{7}'$) broad, some with slender stalk 2–10 Mm. ($\frac{1}{12}$–$\frac{2}{5}'$) long; dorsal surface convex with 3 prominent, longitudinal primary ribs and 4 vittæ, short conical stylopodium at summit; commissural surface with 3 narrow light brown longitudinal areas separated by 2 dark brown areas, each containing 1 vitta; odor and taste aromatic, characteristic. POWDER, yellowish-brown; microscopically—angular fragments of endosperm with aleurone grains each containing a rosette aggregate of calcium oxalate, fragments of vittæ, few sclerenchymatous fibres, parenchyma cells, tracheæ; in mounts with hydrated chloral T. S. many globules of fixed oil separate. *Solvents:* alcohol (extracts virtues—volatile oil); hot water partially. Dose, gr. 10–30 (.6–2 Gm.).

ADULTERATIONS.—FRUIT: Exhausted fruit (yielding yellowish instead of dark brown infusion) often tinged with chrome-yellow (removed by rubbing with alcohol) and mixed with genuine, entire or ground; damaged wheat, oat, poppy and lentil seeds, stones, pieces of marble, colored yellow with iron-ochre, 16–66 p. c.; OIL: Alcohol, oil deprived more or less of anethol, oil of turpentine (lowering the congealing point), other volatile and fixed oils.

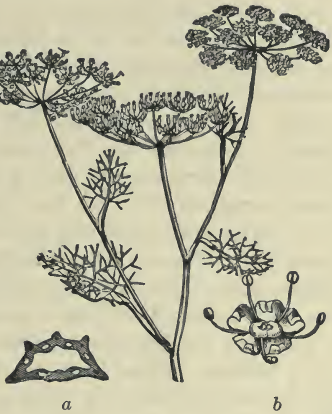


FIG. 286.—*Fœniculum vulgare:* *a*, cross-section of fruit; *b*, flower with stamens.

Commercial.—Plant variation (in size, habit, shape and cutting of leaves, number of rays in umbels, and shape of fruits) is due to the cultivation for centuries of the wild *F. vulgare*, thereby producing several well-marked new species (?) that flourish in all except cold climates, and in turn revert to the original wild form. Fruit is obtained mostly under cultivation from Germany, France, and Russia, although we produce much of our own supply; the French, German, and Indian conform to the official description, the Russian and Japanese being only half the size, as is also the *wild* (*bitter*) grown in France; all sometimes sold as *longs* and *shorts*, the former having preference. Cultivated in Italy not only for fruit, but for stem and young shoots as a vegetable, while the root is used in medicine with less satisfaction. There are five varieties: 1, *French* (*Roman*, *Sweet*), large straight, curved, sweetish, greenish-yellow, by some referred to *F. dulce* or *F. sativum*, but under cultivation it soon reverts to the original wild

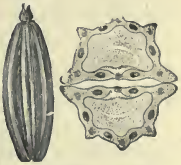


FIG. 287.—Fœniculum fruit: 3 diam.; transverse section, 8 diam.

form, *F. vulgare;* 2, *German* (*Saxon—F. vulgare*), large, greenish, by some preferred; 3, *Indian* (*R. panmo'rium*); 4, *Russian* (*Roumanian*); 5, *Japanese.*

CONSTITUENTS.—Volatile oil 2–6 p. c., fixed oil 12 p. c., sugar, mucilage, ash 9 p. c.

Oleum Fœniculi. Oil of Fennel, *official.*—(Syn., Ol. Fœnic., Fennel Oil; Fr. Essence de Fenouil; Ger. Fenchelöl.) This volatile oil, distilled from the ripe fruit of cultivated varieties with water or steam, is a colorless, pale yellow liquid, characteristic odor and taste of fennel, soluble in 8 vols. of 80 p. c. alcohol, 1 vol. of 90 p. c. alcohol, forming neutral solution, sp. gr. 0.963, dextrorotatory, congeals at 5° C. (41° F.); contains (about the same as oil of anise) pinene, phellandrene ($C_{10}H_{16}$—substances isomeric with oil of turpentine), dipentene (sometimes limonene), fenchone (bitter camphor), $C_{10}H_{16}O$, anethol, $C_{10}H_{12}O$, 60 p c., also its isomer chavicol, anise ketone, anisic aldehyde, and anisic acid. Anethol gives largely the value, crystallizes out in the cold, and consists of two portions (1) liquid—eleoptene, (2) solid—stearoptene, the percentage of the two not always being uniform, some specimens of oil having more of the solid, while others (best) more of the liquid anethol. The oil from different sources is usually without some of these constituents (either phellandrene, fenchone, or anethol), thus limonene occurs in the Macedonian; pinene and dipentene in the Saxon; fenchone in the Saxon, Galician, Moravian, Roumanian and Japanese, but not in the Roman and Macedonian; phellandrene in the wild (bitter), which, as a rule, has no anethol. *Tests:* 1. With ferric chloride T. S.—not blue or dark (abs. of volatile oils containing phenol). 2. Dropped into water and not shaken—no milkiness (abs. of alcohol). Should be kept cool, dark, in well-stoppered amber-colored bottles, and if partly or wholly solidified must be liquefied by careful warming before dispensing. Dose, ♏ij–5 (.13–.3 Ml. (Cc.)).

PREPARATIONS.—I. FRUIT: 1. *Infusum Sennæ Compositum,* 2 p. c.
II. OIL: 1. *Aqua Fœniculi.* Fennel Water. (Syn., Aq. Fœnic.; Fr. Eau de Fenouil; Ger. Fenchelwasser.)

Manufacture: $\frac{1}{5}$ p. c. Similar to Aquæ Aromaticæ—triturate oil .2 Ml. (Cc.) with purified talc 1.5 Gm., adding gradually recently boiled distilled water q. s. 100 Ml. (Cc.), filter until clear. Dose, ℥ij–8 (8–30 Ml. (Cc.)).

2. *Pulvis Glycyrrhizæ Compositus,* $\frac{2}{5}$ p. c. 3. *Spiritus Juniperi Compositus,* $\frac{1}{20}$ p. c.

Unoff. Preps.: I. FRUIT: *Fluidextract,* dose, ♏x–30 (.6–2 Ml. (Cc.)). *Infusion,* 5 p. c., dose, ℥j–16 (4–60 Ml. (Cc.)). II. OIL: *Syrup.*

PROPERTIES.—Carminative, stimulant, stomachic, galactagogue; employed by the ancients very similarly.

USES.—Nausea, colic, amenorrhœa, infantile flatulency; increases the secretion of milk, perspiration, mucus, urine; as a corrective to griping medicines, senna, rhubarb, etc. Much used in cattle medicines; the oil in cordials, elixirs.

UMBELLIFERÆ

CORIANDRUM. CORIANDER.

Coriandrum sativum, *Linné.* { The dried ripe fruit, with not more than 5 p. ç. of other fruits, seeds, foreign matter.

Habitat. C. Asia, S. Europe (China, Italy; cultivated in the United States, Europe.

Syn. Coriand., Coriander Seed, Coliander; Br. Coriandri Fructus; Fr. Coriandre; Ger. Koriander(samen).

Co-ri-an'drum. L. fr. Gr. *κόρις*, a bug—*i. e.*, from a resemblance in odor of the leaves.

Sa-ti'vum. L. *sativus*, sown, cultivated—*i. e.*, kind used, in contradistinction to the wild-grown.

Plant.—Annual herb, odor of bed-bugs; stem .3–.6 M. (1–2°) high, solid; leaves bi- or tripinnate; leaflets linear, pointed, lobed, light green, resembling parsley; flowers June, white, rose-colored, umbels small, 4 Cm. ($1\frac{3}{5}'$) broad, 5–8-rayed. Fruit, cremocarp, subglobular, yellowish-brown, 3–5 Mm. ($\frac{1}{8}$–$\frac{1}{5}'$) broad; summit with 5 calyx teeth and a short stylopodium; mericarps 2, usually coherent but easily separated, each with 5 prominent straight primary ribs and 4 indistinct undulate secondary ribs, commissural surface deeply concave with 2 vittæ on the inner surface; odor and taste agreeably aromatic. Powder, yellowish-brown; microscopically—fragments of endosperm and pericarp, many calcium oxalate crystals, sclerenchymatous fibres, globules of fixed oil, few fragments of vittæ with epidermal cells; volatile extractive, soluble in ether .5 p. c. *Solvents:* alcohol; water partially. Dose, gr. 10–30 (.6–2 Gm.).

Adulterations.—Fruit: Stems, fragments of leaves; Oil: Oils of turpentine, sweet orange, cubeb and cedar-wood—all recognized by being less soluble in 70 p. c. alcohol.

Commercial.—Coriander was popular with the ancients; in the fresh state all parts upon being bruised are fetid, the fruit becoming fragrant only upon drying; when ripe plants are cut down with sickles, dried, and fruit thrashed out. Russia produces the bulk of the crop, although we grow mostly our home consumption; that from Bombay (Indian) is larger and ovoid but seldom reaches the United States.

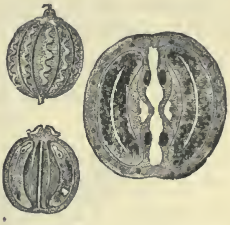


Fig. 288.—Coriandrum: fruit and longitudinal section magnified 3 diam.; transverse section magnified 8 diam.

Constituents.—Volatile oil .5–1 p. c., fat 13 p. c., tannin, malic acid, mucilage, ash 7 p. c.

Oleum Coriandri. Oil of Coriander, *official.*—(Syn., Ol. Coriand., Coriander Oil; Fr. Essence de Coriandre; Ger. Korianderöl.) This volatile oil, distilled with water or steam from the ripe fruit crushed between rollers, is a colorless, pale yellow liquid, characteristic odor and taste of coriander, soluble in 3 vols. of 70 p. c. alcohol, sp. gr. 0.870, dextrorotatory; contains a terpine—*d*-pinene, $C_{10}H_{16}$, 5 p. c., and an alcohol—linalool (coriandrol), $C_{10}H_{18}O$, 90 p. c., from which

1 molecule of H_2O may be withdrawn, leaving $C_{10}H_{16}$. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏ij–5 (.13–.3 Ml. (Cc.)).

PREPARATIONS.—I. FRUIT. (Unoff.) *Fluidextract*, dose, ♏xv–30 (1–2 Ml. (Cc.)). *Infusion*, 5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)).

II. OIL: 1. *Fluidextractum Cascaræ Sagradæ Aromaticum*, $\frac{1}{100}$ p. c. 2. *Spiritus Aurantii Compositus*, 2 p. c. 3. *Syrupus Sennæ*, $\frac{1}{2}$ p. c.

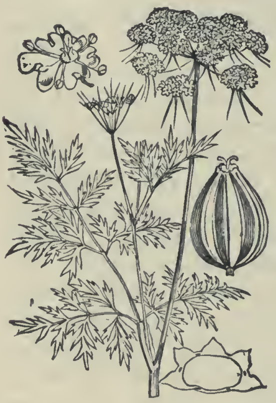


FIG. 289.—*Æthusa Cynapium.*

PROPERTIES. — Aromatic, carminative, stimulant, stomachic.

USES.—Indigestion, flatulency, corrective to griping medicines, such as senna, rhubarb, jalap; flavoring to gin and in cooking. Oil also used in colic, rheumatism, neuralgia.

Allied Plants:

1. *Æthu'sa Cyna'pium, Fool's Parsley, Small Hemlock.* — Leaves non-poisonous, and sometimes carelessly mixed with those of conium — the plants, however, being distinguished easily, as *Æthusa Cynapium* has leaves of different shape, darker color, leek-like odor; occasionally have mixed also the pubescent ciliate leaflets of several species of *Chærophyl'lum.*

2. *Heracle'um lana'tum, Cow-parsnip, Masterwort.*—The root, official 1820–1860; United States. Plant 1.5–3 M. (5–10°) high, 2.5–4 Cm. (1–1$\frac{3}{5}$′) thick, pubescent, hollow; root resembles parsley, disagreeable odor, acrid taste, fruit has each mericarp with 5 ribs and 6 vittæ; contains volatile oil, resin. Used as stimulant, carminative;

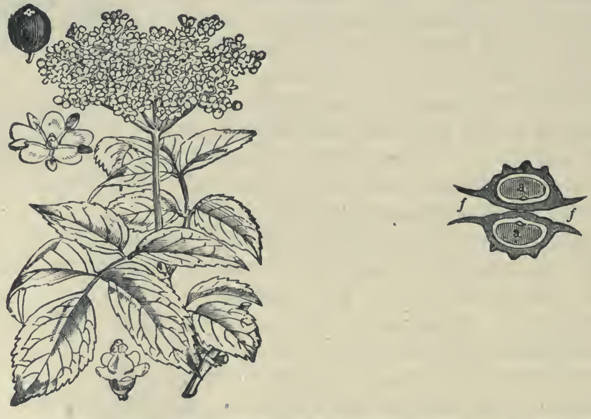


FIG. 290.—Angelica—flowering stem and cross-section of cremocarp: *a*, the seed; *f*, the 2-ribbed wings (mericarps).

epilepsy, dyspepsia, warts, escharotic; in infusion, juice. Dose, ʒss–1 (2–4 Gm.).

3. *Angel'ica Archangel'ica* (*officina'lis*), *European Angelica.*—The root, official 1860–1870; ripe fruit also now used, and *Angelica atropurpu'rea, American* (*Purple-stemmed*) *Angelica;* the root (rhizome), official 1820–1860. Herbs, 1.8–2 M. (5–6°) high; stems purplish, smooth, hollow, jointed; leaves double pinnate; flowers greenish-white; roots 5–10 Cm. (2–4′) long, 2.5–5 Cm. (1–2′) thick, annulate, fusiform, juicy, aromatic, sweetish, pungent, bitter; contains volatile oil, resin, valeric acid. Used as tonic, stimulant, carminative, diaphoretic, emetic, for typhoid condition, bronchitis, intermittents, rheumatism, gout, painful and swollen parts, condiment; in infusion, tincture, fresh juice (poisonous). Dose, gr. 10–30 (.6–2 Gm.); fluidextract (alcohol).

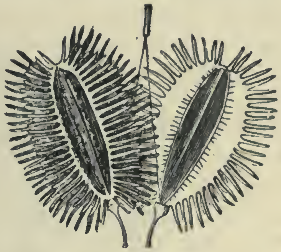


Fig. 291.—*Daucus Carota:* magnified 5 diam.

4. *Dau'cus Caro'ta, Carrot* (*Seed*).—The fruit, official 1820–1880; N. Asia, Europe; biennial herb, .6–1 M. (2–3°) high, hispid; flowers July–Sept., white; root fleshy, fusiform, aromatic, edible; fruit 4 Mm. (⅙′) long, oval, flat, grayish-brown, each mericarp with 9 ribs, 6 vittæ; odor aromatic; taste pungent; contains volatile oil, fixed oil. Used as a stimulant, diuretic, excitant; dropsy, strangury, nephritic affections amenorrhœa, ulcers, eczema, itching; in infusion, fluidextract. Dose, gr. 10–30 (.6–2 Gm.).

ASAFŒTIDA. ASAFETIDA.

Ferula { **Asafœtida,** *Linné,* **fœtida,** (*Bunge*) *Regel,* and other species. } The gum-resin from the rhizome and roots, containing 60 (powdered 50) p. c. of alcohol-soluble constituents.

Habitat. Persia, Turkestan, Afghanistan; mountain slopes, barren desolate wastes, sandy deserts.

Syn. Asafœt., Gum Asafetida, Devil's Dung (Stercus Diaboli), Food of the Gods (Cibus Deorum), Gummi-resina Asafœtida; Fr. Asa Fœtida; Ger. Asa fœtida, Asant, Stinkasant, Teufelsdreck.

Fer'u-la. L. fr. *ferio, ferire,* to strike—*i. e.,* stems used as rods, with which, at one time, schoolboys were punished.

Fœt'i-da. L. *fœtidus,* fetid, stinking—*i. e.,* the odor of the plant, and its secretion.

As'a-fœt'i-da. L. fr. Pers. *aza, asa,* mastic, + L. *fœtida,* fetid, stinking—stinking mastic—*i. e.,* its odor, resemblance, and consistency.

Plants.—Large perennial herbs; stems 1.5–3 M. (5–10°) high, 2.5–7.5 Cm. (1–3′) thick, greenish, erect, furrowed, smooth; leaves few, radical and cauline, mostly near stem's base, .3–.6 M. (1–2°) long and broad, on stout round petioles, 22.5 Cm. (9′) long, expanding below into inflated sheath surrounding one-half the stem, imparipinnate, ternately divided, each bipinnate with few pinnæ, leaflets few; flowers small, monœcious, yellow; roots conical, 45 Cm. (18′) long, 10–15 Cm.

(4–6′) thick, branched, dark brown, internally whitish. GUM-RESIN (asafetida), in soft mass, semi-liquid, irregular pliable masses composed of agglutinated tears of variable size imbedded in yellowish-brown matrix, or in loose ovoid tears, 1–4 Cm. ($\frac{2}{5}$–1$\frac{3}{5}$′) broad, surface often with streaks of violet, yellowish-red, brownish, few vegetable fragments; soft or tough (fresh), hard even brittle (dry); fresh fractured surface of tears milky-white and opaque, changing gradually on exposure to pinkish, reddish-purple; tears moistened with water—milky-white; odor persistent, alliaceous; taste bitter, alliaceous, acrid. POWDER, light brown. *Tests:* 1. Triturate with water (3)—milk-white emulsion, yellowish with alkalies. 2. Heat tear with sulphuric acid—reddish-brown solution, which diluted with water, filtered, + excess of alkali —blue fluorescent solution, more pronounced with excess of ammonia water. 3. Alcohol solution + few drops of phloroglucinol T. S. + few drops of hydrochloric acid—cherry-red. 4. Incinerate—ash 15 (gum-resin)–30 (powder) p. c. *Impurities:* Foreign resins, ammoniac, galbanum, rosin, etc. *Solvent:* alcohol. Dose, gr. 3–10 (.2–.6 Gm.).

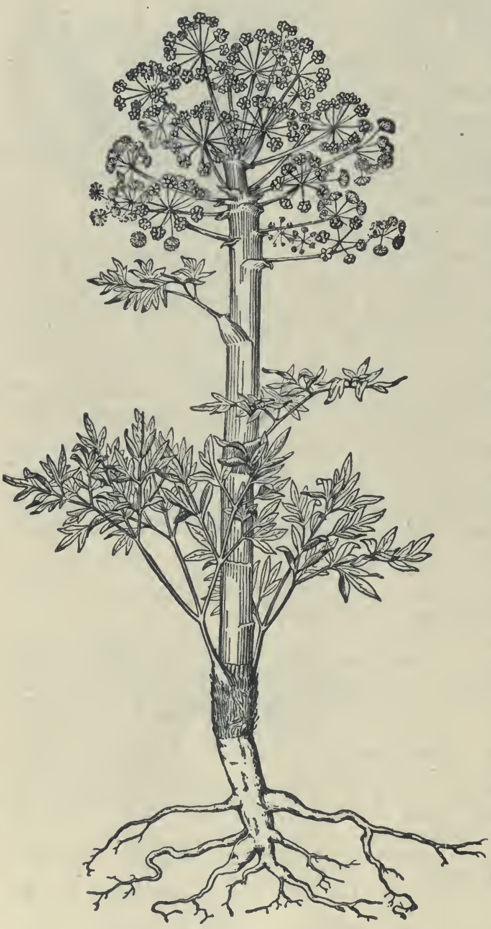


FIG. 292.—*Ferula fœtida.*

ADULTERATIONS.—Divisible into 4 groups: 1, plant's tissues (insoluble in alcohol); 2, local associated gums; 3, earthy substances (ash, alcohol-insoluble residue); 4, turpentine products. Although some of these are added after reaching Europe, most of the adulterating occurs in its native country at Herat, before being conveyed to Bombay, where are used red clay (tawah), sand, stones, wheat or barley flour, gypsum, calcium carbonate, calcium sulphate, cloth, bristles, wood, rosin, resins, translucent gums—all amounting sometimes to 60–80 p. c., and yielding an ash of 15–20–40 p. c.; at present rigorously inspected with us so as to comply with official requirements.

Commercial.—Asafetida has been known in the East from early times and much studied since 1687; plants endure many years, producing each spring simply a crop of radical leaves but finally a scape with flowers and then die; the oldest are most productive, none being cut until the 5th year. In April, when leaves begin to wither, collection is started by pulling off the leafy stem, laying bare the upper portion of root-stock, 5–7.5 Cm. (2–3′) deep, and cutting a slice from the top, whereupon milky juice exudes but is not collected; the fresh exposed surface is protected from the sun's heat by a covering (*khora*), a crude domed structure several inches high of herbage and twigs, surmounted by clay and stones, save an opening on the north. On returning in about 40 days (May) the cut surface is found covered with a thick, gummy, reddish substance, not milky but in more or less irregular lumps resembling ordinary asafetida, which is scraped off into cups or leather (kid, goat) bags, and a thin slice of the root removed for fresh exudation—a process repeated at 10-day intervals until the root perishes or is exhausted (2 months); each subsequent cutting yields a thicker, better juice provided the root be screened properly all the time from the sun. The product from many plants is mixed, further hardened in the sun and forwarded to Herat, whence it enters commerce via Bombay, in skins, mats (80–90 pounds; 36–40.5 Kg.), boxes (200–400 pounds; 91–182 Kg.), and casks. Each root yields ½–32 ounces (.015–1 Kg.); the purest, called natively *hing* (usually soft, transparent, and considered a stem product) is consumed in India, while the mixed, called *hingra,* alone is exported. It may be powdered when excessively cold, or by drying over freshly burnt lime or exposure to currents of warm air, then reducing at low temperature; starch or magnesium carbonate as a diluent will maintain powdered form. There are four varieties: 1, *Amygdaloid* (*Lump*), official kind, considered most reliable; 2, *Tears,* inferior, consisting of various-sized tears (pea, walnut), yellowish, roundish, flattened, oval, irregular-shaped, distinct or adhesive and agglutinated; 3, *Stony,* various-sized, angular or rounded pieces of gypsum and other earthy matters agglutinated or merely coated with the milky juice, and should not be used in medicine; 4, *Liquid,* white, opaque, syrupy, or semi-fluid mass turning brown with age, possibly the first exudate or due to moist season.

CONSTITUENTS.—Gum 20–30 p. c., Resin 60–70 p. c., Volatile oil 6–9 p. c., vanillin .06 p. c., free ferulic (ferulaic) acid 1.3 p. c., free asaresino-tannol 1 p. c., formic, acetic, valeric and malic acids, ash (pure) 3–4 p. c.

GUM.—Partly soluble in water, the residue (bassorin) dissolves in alkalies, being reprecipitated by acids.

RESIN.—Reddish-brown, amorphous, soluble in ether except 3–4 p. c. It is the ferulic acid ester of asaresino-tannol, and contains ferulic acid, $C_{10}H_{10}O_4$, and resino-tannol, $C_{24}H_{35}O_5$; upon dry distillation yields umbelliferon, $C_9H_6O_3$, and blue-colored oils; when fused with potassium hydroxide gives resorcin and protocatechuic acid.

Volatile Oil.—This, to which the odor and stimulating property are due, is obtained by distilling with water or alcohol; sp. gr. 0.980; it is a mixture of several sulphides of ferulyl ($C_7H_{14}S_2$ and $C_{11}H_{20}S_2$), two terpenes ($C_{10}H_{16}$ and $C_{10}H_{16}O$), the latter yielding a sesquiterpene, $C_{15}H_{24}$, and a blue-colored oil in the higher boiling portions.

PREPARATIONS.—1. *Emulsum Asafœtidæ.* Emulsion of Asafetida. (Syn., Emuls. Asafœt., Milk of Asafetida, Mistura (Lac) Asafœtidæ; Fr. Mixture (Lait) d'Asafœtida; Ger. Asafœtidaemulsion, Stinkasantmilch.)

Manufacture: 4 p. c. Rub asafetida (tears, selected masses) 4 Gm. in a mortar with water, gradually added, q. s. 100 Ml. (Cc.), strain, mix thoroughly. Dose, ℥ss–1 (15–30 Ml. (Cc.)).

2. *Pilulæ Asafœtidæ.* Pills of Asafetida. (Syn., Pil. Asafœt.; Fr. Pilules d'Asafétide; Ger. Asafœtidapillen.)

Manufacture: Beat together asafetida 20 Gm., soap 6 Gm., water q. s. 100 pills. Dose, 2–5 pills.

3. *Tinctura Asafœtidæ.* Tincture of Asafetida. (Syn., Tr. Asafœt.; Fr. Teinture d'Asefétide; Ger. Tinctura Asæ-fœtidæ, Stinkasanttinktur.)

Manufacture: 20 p. c. Similar to Tinctura Aloes, page 110; menstruum, alcohol. Dose, ʒss–1 (2–4 Ml. (Cc.)).

Unoff. Preps.: Asafœtida Præparata—exhaust with alcohol, thereby eliminating gum, evaporate or pour solution into slightly acidulated water, getting resin and volatile oil. *Dewees' Carminative,* dose, ʒss–4 (2–15 Ml. (Cc.)). *Spiritus Ammoniæ Fetidus* (Br.), asafetida 7.5 p. c., dose, ʒj–2 (4–8 Ml. (Cc.)). *Enema* (1 to 64 water). *Pil. Galbani Comp.*, dose, 2–4 pills. *Plaster. Suppositories.*

PROPERTIES.—Similar to other drugs with volatile oils; stimulant, antispasmodic, expectorant, laxative, (emmenagogue, anthelmintic, condiment).

USES.—Hysteria, hypochondriasis, convulsions, spasms, whooping-cough, measles, asthma, coughs, catarrhs, flatulent constipation, chorea, nervous apoplexy, consumption. Used in India, Persia, etc., as a condiment, for flavoring food, etc., like garlic and onions; acts here as a stimulant to the bowels and digestion. The natives value it highly, not only for its agreeable effect, but also for the odor and taste; a tolerance of this latter in most cases is acquired gradually by usage, as at first it is often nauseous and positively disgusting.

Incompatibles: Cerebral and arterial depressants, cold, acids, neutral salts; water with alcoholic liquid preparations.

Synergists: Cerebral excitants, alcohol, ether, gum-resins, balsams, aromatics, volatile oils containing sulphur and phosphorus.

Allied Plants:

1. *Ferula Nar'thex* (*Narthex assafœt'ida*); official 1820–1890.—This plant is almost identical with *F. fœtida,* and from it much gum-resin is collected and sent in with the official. It is almost impossible to recognize plant origin by the product.

2. *F. galbanif'lua, Galbanum.*—Gum-resin, official 1820–1890; N. Persia. Plant 1.3–1.6 M. (4–5°) high, 2.5 Cm. (1′) thick, solid, striate; leaves radical and cauline; flowers yellow; fruit 12 Mm. (½′) long, winged near face of mericarps. Gum-resin in tears size of pinhead to that of a pea, brownish-yellow, inside milk-white, waxy, odor peculiar, balsamic, taste bitter, acrid, with water gives milky emulsion. Obtained from incisions; contains gum 15–20 p. c., resin 60–66 p. c., volatile oil 10–20 p. c., free umbelliferon .25 p. c., umbelliferon combined with galbano-resino-tannol 20 p. c., ash 8–10 p. c. Used as stimulant, expectorant, antispasmodic; hysteria, chlorosis, catarrh, amenorrhœa, rheumatism, bronchitis, for church incense, tumors, boils, in pill (pilula galbani composita), emulsion, plasters, tincture. Dose, gr. 5–20 (.3–1.3 Gm.). It is intermediate between asafetida and ammoniac.

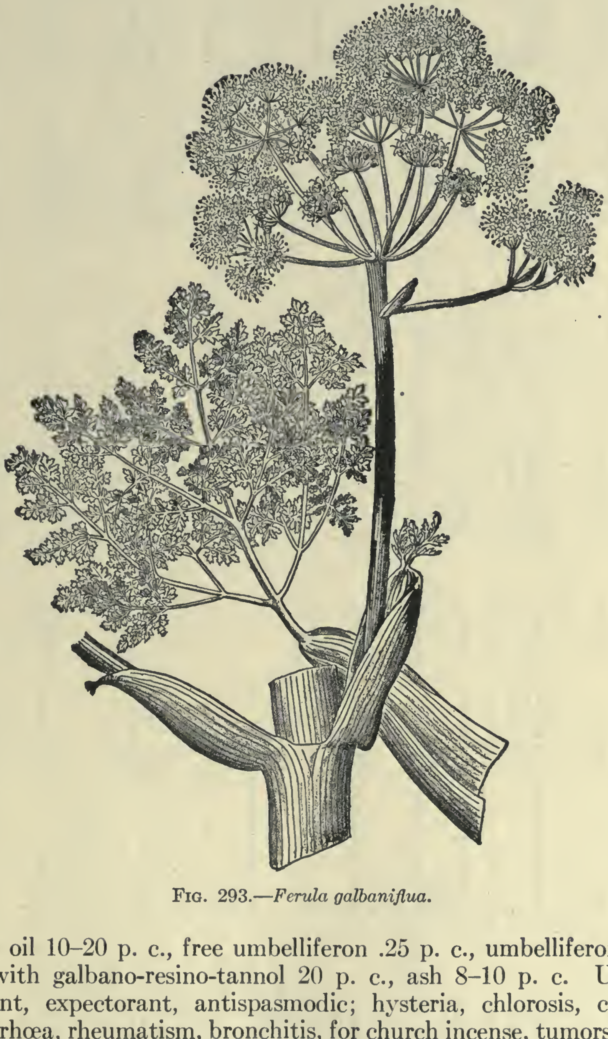


Fig. 293.—*Ferula galbaniflua.*

RECAPITULATION No. 5.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
Sapindaceæ: 1. Guarana. 2. Guarana.	Paullinia Cupana.	The dried paste from the crushed seeds.	N. and W. Brazil.	Caffeine, tannin, resin, volatile oil, fat, saponin.	Fluidextract.	Nervine, stimulant, tonic, astringent.	Sick headache, migraine, diarrhœa of phthisis, convalescence.	15–60 (1–4 Gm.).
Rhamnaceæ: 1. Frangula. 2. Frangula.	Rhamnus Frangula.	The dried bark.	Europe, N. Asia.	Frangulin, emodin, isoemodin, resin, tannin.	Fluidextract.	Purgative, tonic, diuretic, emetic.	Dropsy, costiveness, constipation of pregnancy.	30–60 (2–4 Gm.).
1. Cascara Sagrada. 2. Cascara Sagrada.	Rhamnus Purshiana.	The dried bark.	Western U. States.	Emodin, isoemodin, resin, tannin, vol. oil, rhamnol, ferment.	Fluidextract, extr., aro. fluidextr.	Purgative, tonic, febrifuge.	Constipation, dyspepsia, hemorrhoids.	15–60 (1–4 Gm.).
Malvaceæ: 1. Althæa. 2. Althæa.	Althæa officinalis.	The dried root.	Europe, W., N. Asia, United States.	Asparagin, mucilage, starch, pectin.	Mas. hydrarg., pil. ferri carb., pil. phosphori.	Demulcent, emollient.	Inflammations of pulmonary, digestive, and urinary tracts, skin eruptions.	30–60 (2–4 Gm.).
1. Gossypium Purificatum. 2. Purified Cotton	. . . . Gossypium herbaceum, +.	The hairs of the seeds.	. . . .	Cellulose, fixed oil, inorganics.	Pyroxylin, collodion, flex., canthar. collodions.	Protective.	Dressing to burns, surgical wounds, etc.	
1. Oleum Gossypii Seminis. 2. Cottonseed Oil.	. . . .	The fixed oil.	. . . .	Olein, palmitin, linolein.	Soft soap, lins. s. soap, ammon., camph.	Demulcent, nutrient.	For olive, almond oil, liniments.	Minims. 120–480 (8–30 Ml. (Cc.)).
Sterculiaceæ: 1. Oleum Theobromatis. 2. Oil of Theobroma.	Theobroma Cacao.	The concrete fixed oil.	S. America.	Stearin, palmitin, laurin, linolein, glycerides of formic, acetic, butyric acids.	. . . .	Demulcent, emollient, nutrient.	Abraded surfaces, base for suppositories, ointments.	Grains. 30–60 (2–4 Gm.).
Theaceæ, see *Rubiaceæ*.	Thea sinensis.							
Guttiferæ: 1. Cambogia. 2. Gamboge.	Garcinia Hanburii.	The gum-resin.	Camboja, Annam, Siam.	Gum, resin (cambogic acid), vol. oil.	Pil. cathar. comp.	Drastic, hydragogue cathartic.	Liver and kidney diseases, vermifuge, dropsy.	$\frac{1}{2}$–5 (.03–.3 Gm.).
Thymelæaceæ: 1. Mezereum. 2. Mezereum.	Daphne: Mezereum, Gnidium, Laureola.	The dried bark.	Europe.	Acrid resin, acrid volatile oil, daphnin.	Fluidextr. sars. co.	Stimulant, diuretic, diaphoretic, alterative, sialagogue, vesicant.	Syphilis, scrofula, rheumatism, skin diseases.	1–10 (.06–.6 Gm.).

Lythraceæ:								
1. Granatum. 2. Pomegranate.	Punica Granatum.	The dried bark of stems and roots.	S. W. Asia, India.	Punico-tannic acid, pelletierine, mannite, gum, pectin.	Fluidextract, pelletierine tannate.	Anthelmintic, tæniafuge, astringent.	Tape- and lumbricoid worms.	30–120 (2–8 Gm.).
Myrtaceæ:								
1. Oleum Cajuputi. 2. Oil of Cajuput.	Melaleuca Leucadendron.	The volatile oil.	E. India Islands.	Cineol, terpineol, *l*-pinene, valer., benz., aldehydes.	....	Carminative, stimulant, diaphoretic, rubefacient.	Rheumatism, affections of stomach, bowels, colic, toothache, bronchitis, dysmenorrhœa.	Minims. 2–10 (.13–.6 Ml. (Cc.)).
1. Caryophyllus. 2. Clove.	Eugenia aromatica.	The dried flower-buds.	Molucca (Clove) Islands.	Volatile oil, tannin, gum, resin, caryophyllin, eugenol.	Tinct. lavend. comp., tinct. rhei ar., Oil.	Stimulant, stomachic, antispasmodic, rubefacient.	Nausea, colic, condiment, rheumatism, neuralgia, toothache.	Grains. 5–10 (.3–.6 Gm.).
1. Oleum Pimentæ. 2. Oil of Pimenta.	Pimenta officinalis.	The vol. oil from fruit.	C. and S. America.	Eugenol, sesquiterpene.	....	Stomachic, stimulant, carminative, condiment.	Flatulence, nausea, colic, rheumatism, neuralgia.	Minims. 1–5 (.06–.3 Ml. (Cc.)).
1. Eucalyptus. 2. Eucalyptus.	Eucalyptus globulus.	The dried leaves.	Australia.	Volatile oil, tannin, cerylic alcohol, eucalyptic acid, resins.	Fluidextract, oil, eucalyptol.	Febrifuge, stimulant, astringent, antiseptic, diaphoretic.	Intermittents, urinary and pulmonary troubles, bronchitis, hemorrhages, gleet, ulcers.	Grains. 15–60 (1–4 Gm.).
Umbelliferæ:								
1. Petroselinum. 2. Parsley Fruit.	Petroselinum sativum.	The dried ripe fruit.	S. Europe, Asia, U. S.	Volatile oil, apiol, resin, tannin.	Oleoresin.	Diuretic, stim., emmenag., antiperiod., germicide.	Nephritis, dropsy, amenorrh., dysmenorrh.	10–30 (.6–2 Gm.).
1. Carum. 2. Caraway.	Carum Carvi (Carui).	The dried fruit.	C. and W. Asia.	Volatile oil, fixed oil, resin, sugar, gum, tannin.	Tr. card. co., *Oil:* spt. junip. co.	Stimulant, carminative, diuretic. stomachic.	Colic, flatulence, flavoring, toothache.	10–30 (.6–2 Gm.).
1. Anisum. 2. Anise.	Pimpinella Anisum.	The dried ripe fruit.	W. Asia, S. Europe.	Volatile oil, fixed oil, choline, sugar, mucilage.	*Oil:* Aq., spt., spt. aurant. co., syr. sars. co., fldext. cas. sag. ar., tr. opii camph.	Stimulant, carminative, stomachic, aromatic.	Colic, flatulence, bronchitis, catarrhs, flavoring.	10–30 (.6–2 Gm.).
1. Fœniculum. 2. Fennel.	Fœniculum vulgare.	The dried ripe fruit.	S. Europe, W. Asia.	Volatile oil, fixed oil, sugar, mucilage.	Comp. inf. sen., *Oil:* pulv. glycyr. co., spt. junip. co.	Carminative, stimulant, galactagogue.	Nausea, colic, amenorrhœa, flatulence, increases secretions.	10–30 (.6–2 Gm.).
1. Coriandrum. 2. Coriander.	Coriandrum sativum.	The dried ripe fruit.	C. Asia, S. Europe.	Volatile oil, tannin, malic acid, mucilage.	*Oil:* fldext. cas. sag. ar., spt. aurant. co., syr. sennæ.	Aromatic, carminative, stimulant, stomachic.	Indigestion, flatulence, flavoring, rheumatism.	Grains. 10–30 (.6–2 Gm.).
1. Asafœtida. 2. Asafetida.	Ferula: asafœtida, fœtida.	The gum-resin.	Persia, Turkestan.	Gum, resin, volatile oil, vanillin, ferulic acid.	Emulsion, pill, tinct.	Stimulant, antispasmodic, laxative, emmenagogue.	Hysteria, spasms, asthma, catarrhs, chorea, consumption, flatulence.	3–10 (.2–.6 Gm.).

SUMBUL. SUMBUL.

Ferula Sumbul, (*Kauffmann*) *Hooker filius.* } The rhizome and roots.

Habitat. C. and N. W. Asia; Turkestan, Bucharia, Russia, E. Siberia; mountains, 900–1200 M. (3000–4000°) elevation.

Syn. Musk-root, Sumbul Radix; Fr. Racine de Sumbul; Ger. Sumbulwurzel, Moschuswurzel.

Sumbul. L. fr., Ar., Pers., Hind., *sumbul*, spikenard—their native name, *sumboul*, a spike—*i. e.*, the appearance of the flowering stem.

Plant.—Perennial herb, dying after flowering; stem erect, 2–3 M. (6–10°) high, 4 Cm. (1$\frac{3}{5}$′) thick at base, solid, glabrous, purplish, exuding milky juice when injured, with 12 stiff, slender, divaricate branches in the upper half; leaves—radical .8 M. (2$\frac{1}{2}$°) long, triangular, tripinnate, with short, channeled, completely clasping petiole, leaflets ovate, deeply divided into wedge-shaped segments, dentate, bright green—cauline decrease in size toward summit, flowers polygamous, umbels, 10–15-rayed; fruit 12 Mm. ($\frac{1}{2}$′) long, 6 Mm. ($\frac{1}{4}$′) broad, mericarps with 3 faint, thread-like dorsal ridges, no dorsal vittæ, the commissural ones collapsed. Rhizome, fusiform, vertical, in transverse segments, 2.5–10 Cm. (1–4′) long, 2.5–7 Cm. (1–2$\frac{4}{5}$′) thick, light brown, longitudinally wrinkled, upper portions with smooth, grayish, epidermal layer, occasionally with the short stem-bases; fracture short, fibrous, spongy; internally brownish-yellow, arrangement of wood irregular, with yellowish-brown resinous patches frequently over entire ends; odor peculiar, musk-like; taste bitter, aromatic. Powder, grayish-brown; microscopically — numerous irregular, brownish fragments and isolated tracheæ, occasional fragments of epidermal cells, many fragments consisting of a granular substance of ill-defined cellular structure, sieve tissue, parenchyma with few starch grains, .003–.012 Mm. ($\frac{1}{8325}$–$\frac{1}{2075}$′) broad. *Solvent:* alcohol (65–75 p. c.). Dose, gr. 10–30 (.6–2 Gm.).

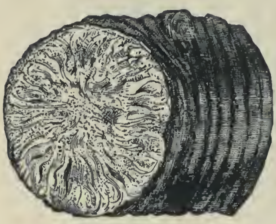


Fig. 294.—Sumbul root: section.

Commercial.—Plant which should furnish our official product, first described by Kauffmann in 1871, was discovered, 1869, in the mountains separating Russian Turkestan from Bucharia; much of the commercial article, however, comes from other sources (*F. suave'olens* (?), with faint, musky odor) through Moscow, being accepted as "false musk-root" or "false sumbul." A root of unknown source, but of supposed umbelliferous characteristics and marshy habit, has long been used in India and Persia under the name of *sumbul* or *jatamansi*, as a perfume incense, and medicine; Russian physicians first employed it, being offered as a substitute for musk as early as 1835.

Constituents.—Volatile oil (bluish, peppermint taste), .33–1 p. c., Resin (soft, musk odor) 9 p. c., fixed oil 17 p. c., angelic acid (sumbulic acid), $C_5H_8O_2$, valeric acid, $C_5H_{10}O_2$, methylcrotonic acid, bitter extractive, sugar, starch, ash 5–6 p. c.; dry distillation gives bluish volatile oil, containing umbelliferon.

Preparations. — 1. *Extractum Sumbul.* Extract of Sumbul. (Syn., Ext. Sumbul, Extract of Musk-root; Fr. Extrait de Racine de Sumbul; Ger. Sumbul (Moschus)-wurzelextrakt.)

Manufacture: Macerate, percolate 100 Gm. with 80 p. c. alcohol until exhausted, reclaim alcohol, evaporate residue at 70° C. (158° F.), frequently stirring, to pilular consistence; yield 15 p. c. Dose, gr. 2–5 (.13–.3 Gm.).

2. *Fluidextractum Sumbul.* Fluidextract of Sumbul. (Syn., Fldext. Sumbul, Fluid Extract of Sumbul, Fluidextract of Musk Root; Fr. Extrait fluide de Sumbul; Ger. Sumbulwurzel (Moschuswurzel) fluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: 80 p. c. alcohol. Dose, ♏x–30 (.6–2 Ml. (Cc.)).

Unoff. Preps.: Tincture, 10 p. c. (67 p. c. alcohol), dose, ʒss–2 (2–8 Ml. (Cc.)). *Resin,* dose, gr. 1–2 (.06–.13 Gm.).

Properties. — Stimulant, carminative, tonic, nervine (resembles musk and valerian), antispasmodic.

Uses.—Hysteria, female nervousness, epilepsy, chlorosis, amenorrhœa, asthma, delirium tremens, bronchitis, leucorrhœa, gleet, typhoid, atonic dysentery, hypochondriasis; often combined with asafetida in nervous troubles, with iron, arsenic, etc., in chlorosis.

Incompatibles and *Synergists:* Same as for asafetida; all preparations immiscible with water.

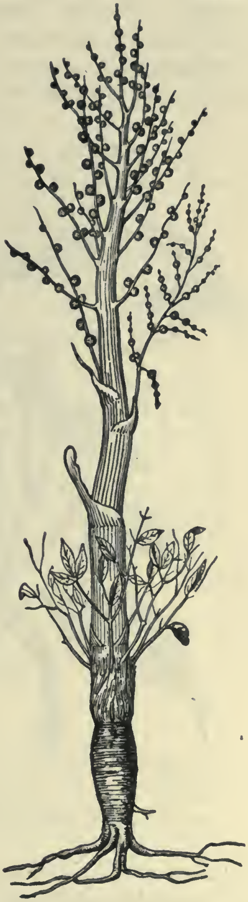


Fig. 295.—*Dorema Ammoniacum.*

Allied Plants:

1. *Dore'ma Ammoni'acum, Ammoniacum, Ammoniac.*—The gum-resin, official 1820–1900; E. Persia, Turkestan. Plant of striking appearance, dying after flowering; stem 1.6–2 M. (5–7°) high, greenish, joints greenish-purple; flowers small, white; leaves—radical and cauline. Gum-resin (ammoniac) exudes from stem and root, through fissures (due to varying temperature) or animal and insect punctures. It is in *tears* or *cakes*, the former preferred when 1.5–6 Mm. ($\frac{1}{16}$–$\frac{1}{4}'$) thick, yellowish, fracture conchoidal, waxy, milk-white; odor peculiar;

taste acrid, bitter, nauseous; contains gum 18–28 p. c., resin 70 p. c., volatile oil 1–4 p. c., ash 1–4 p. c. Stimulant, expectorant, rubefacient, similar to but less powerful than asafetida; bronchitis, chronic catarrh, asthma, pleurisy; externally resolvent in white swelling, tumors, glandular enlargements. Dose, gr. 10–30 (.6–2 Gm.); emulsion (water—milky), 4 p. c., ℥ss–1 (15–30 Ml. (Cc.)). The root, under the name of Bombay Sumbul or Boi, although of closer texture, firmer, denser, and more reddish is used largely to adulterate the "false sumbul" so prevalent with us in the past, but it in reality resembles more closely our present official root (*Ferula Sumbul*). *D. Au'cheri*, W. Persia, yields also a similar product (ammoniac), while *D. robus'tum* gives a dissimilar gum-resin.

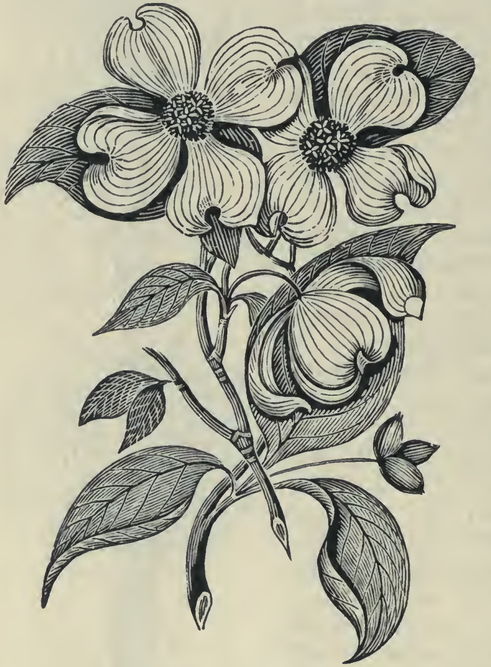


Fig. 296.—*Cornus florida.*

2. *Ferula tingita'na, African Ammoniac.*—This is thought to be the "ammoniacum" of the ancients; it is darker than our ammoniac, odor agreeable, like benzoin, taste acrid, bitter; contains gum 9 p. c., resin 68 p. c., and yields umbelliferon.

3. *Opop'anax Opopanax (Chiro'nium).*—S. Europe. Root and stem exude yellowish milk, hardening into reddish-brown tears, having a waxy lustre, and a bitter, balsamic taste.

4. *Cor'nus flor'ida, Flowering Dogwood.*—Cornaceæ. The dried bark of root, official 1830–1890; N. America. Small tree, 4.5–10.5 M. (15–35°) high, 12.5–25 Cm. (5–10′) thick, flowers greenish with 4 large white involucral leaves, petaloid; fruit bright red. Bark deprived of the furrowed brown-gray outside corky layer, in curved pieces 3 Mm. ($\frac{1}{8}$′) thick, reddish-brown color, striate, astringent, bitter; contains cornin (cornic acid), tannin 3 p. c., resin. Used as astringent, tonic, febrifuge, stimulant, as substitute for cinchona, when fresh emetic; in decoction, fluidextract (glycerin 15, dil. alc. 85). Dose, gr. 15–60 (1–4 Gm.).

5. *C. circina'ta, Round-leaved Dogwood.*—The bark, official 1820–1880; N. America. Shrub 1.6–3 M. (5–10°) high, branches greenish,

warty; leaves round, 10–12.5 Cm. (4–5′) wide, woolly beneath; flowers white cymes; fruit, blue drupe. Bark quilled, curved, greenish, brownish-gray, with suberous warts or longitudinal lines, inside cinnamon-brown; used like *C. florida,* but is more bitter and less astringent.

6. *C. Amo′num (seric′ea), Silky Cornel, Swamp Dogwood.*—The bark, official 1820–1880; N. America. Shrub 1.6–3 M. (5–10°) high, branches purple; leaves elliptical, silky beneath; flowers yellowish, woolly cymes; fruit pale blue. Bark quilled, thin, outside purplish-brown, less warty than preceding, otherwise resembles it; used like *C. florida*, but is less bitter and astringent.

SERIES 2: **GAMOPETALÆ.** Petals more or less united, rarely separate or wanting.

54. ERICACEÆ. Heath Family.

Er-i-ka′se-e. L. *Eric-a* + aceæ, Gr. ἐρείκη, heath, fr. ἐρείκω, to break—*i. e.*, because some species break or dissolve stone in the bladder. Shrubs, small trees. Distinguished by astringent properties; leaves evergreen, exstipulate; calyx 4–5-cleft, inferior, corolla regular, hypogynous, 4–5-cleft; stamens as many or twice corolla-lobes, free from but inserted with corolla; anthers 2-celled; ovary 2–5-celled, style 1; fruit, capsule, or berry, edible; universal; astringent, tonic, diuretic, narcotic, poisonous.

Genera: **1. Gaultheria. 2. Arctostaphylos.**

GAULTHERIA. GAULTHERIA.

Methylis Salicylas. Methyl Salicylate, *official.*

Gaultheria procumbens, *Linné,* **Betula lenta,** *Linné.*	An ester (compound ether) obtained by distilling leaves of the former and bark of the latter, also synthetically.

Habitat. N. America, Newfoundland to Georgia, Minnesota; cold damp woods (shade of evergreens); forests.

Syn. Wintergreen, Spring (Creeping, Spicy, Aromatic) Wintergreen, Checker (Partridge) berry, Tea (Spice) berry, Mountain Tea; Black (Cherry, Mahogany, Sweet, Spice) Birch, Mountain Mahogany; Methyl. Salicyl., Oleum Gaultheriæ, U. S. P. 1900, Oil of Wintergreen; Oleum Betulæ, U. S. P. 1900, Oil of Sweet Birch, Oil of Teaberry; Fr. Salicylate de Méthyle; Ger. Künstliches Wintergrünöl.

Gaul-the′ri-a. L. dedicated by Kalm to Dr. Gaulther, of Quebec.

Pro-cum′bens. L. *pro*, forward, + *cumbere*, to lie, lying down—*i. e.*, the reclining habit of the stem.

Bet′u-la. L. fr. Celtic *betu*, the birch—*i. e.*, its original name.

Len′ta. L. *lentus*, soft, pliant, flexible—*i. e.*, its stems and branches.

PLANTS.—*Gaultheria procumbens*, stems slender, creeping on or below the surface, branches ascending, leafy at summit, 5–15 Cm. (2–6′) high; leaves obovate, alternate, evergreen, spicy, mucronate, serrate; flowers, June–Sept., few, white, nodding, mostly single in the axils; fruit (formed of calyx) bright red berries (capsules), 5-celled, spicy, aromatic; *Betula lenta*, tree 12–24 M. (40–80°) high, .6–1 M. (2–3°) thick; bark dark brown, close, smooth, sweet, aromatic; leaves 7.5–10 Cm. (3–4′) long, 2.5–5 Cm. (1–2′) broad, ovate, acuminate, serrate, petiolate; flowers, staminate (catkins) and pistillate; bark not separable into layers, cambium when wounded in the spring, exudes sweet, acid, edible juice; wood reddish, strong, compact.

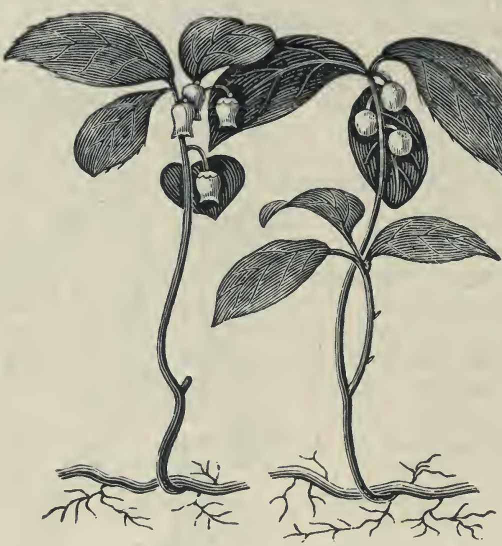


Fig. 297.—*Gaultheria procumbens.*

Constituents.—Methyl Salicylate (Volatile oil), resin, tannin 3–6 p. c., gaultherin, betulin.

Methylis Salicylas. Methyl Salicylate, $CH_3C_7H_5O_3$.—While this constitutes 99 p. c. of the commercial oils of gaultheria and betula, it is obtained largely synthetically by distilling salicylic acid, or a salicylate, with methyl alcohol and sulphuric acid (abstracting water as eliminated), the methyl salicylate distilling over and floating on the surface—$HC_7H_5O_3 + CH_3OH + H_2SO_4 = CH_3C_7H_5O_3 + H_2O + H_2SO_4$. It is a colorless, yellowish, reddish liquid, characteristic odor and taste of gaultheria, soluble in 70 p. c. alcohol (6), with not more than slight cloudiness, sparingly in water, miscible with alcohol and glacial acetic acid; alcoholic solution neutral, slightly acid, sp. gr. 1.180–1.185 (synthetic), 1.172–1.182 (from gaultheria or sweet birch); boils at 220° C. (428° F.); optically inactive (synthetic and sweet birch), slightly lævorotatory (gaultheria); contains 98 p. c. of methyl salicylate. *Tests:* 1. Shake a drop with 5 Ml. (Cc.) of distilled water, + a drop of ferric chloride T. S.—deep violet color. *Impurities:*

Heavy metals, volatile oils, petroleum products. The label must indicate definitely its specific source. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–10 (.06–.6 Ml. (Cc.)).

PREPARATIONS.—1. *Emulsum Olei Morrhuæ,* $\frac{2}{5}$ p. c. 2. *Fluidextractum Cascaræ Sagradæ Aromaticum,* $\frac{1}{50}$ p. c. 3. *Syrupus Sarsaparillæ Compositus,* $\frac{1}{50}$ p. c.

Unoff. Preps.: Petroxolin, 20 p. c., liquid petroxolin 80. *Spiritus Gaultheriæ,* 5 p. c., dose, ʒj–2 (4–8 Ml. (Cc.)). *Nebulæ. Trochisci,* etc.

PROPERTIES AND USES.—Similar to salicylic acid: Antiseptic, analgesic, stimulant, carminative, flavoring; muscular rheumatism, lumbago, sciatica; locally applied upon lint over swollen joints, acute articular rheumatism, tic douloureux, etc. Amount may be increased, if no impairment of digestion, until full effect produced.

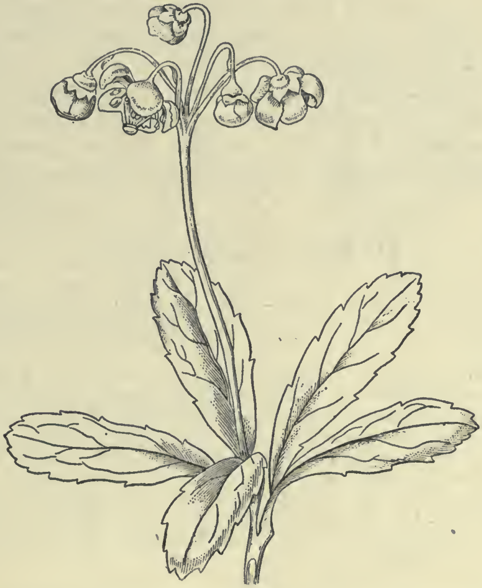


FIG. 298.—*Chimaphila umbellata:* upper part of flowering stem.

Poisoning: Large quantities produce drowsiness, cerebral congestion, delirium, gastric irritability, vomiting, purging, intestinal pain, rapid pulse, hot dry skin, difficult breathing; give diffusible stimulants —ether, alcohol, ammonia, etc.

Leaves of *Gaultheria,* official 1820–1890; *Oleum Gaultheriæ,* official 1820–1910; *Oleum Betulæ* (*Volatile*), official 1890–1910.

Allied Plants.

1. *Chimaph'ila umbella'ta, Pipsissewa, Prince's Pine.*—Pyrolaceæ. The dried leaves, official 1830–1910; N. America, Europe, Asia, dry woods. Perennial, evergreen herb, 10–25 Cm. (4–10′) high; rhizome

creeping, yellowish; flowers, terminal umbel, corymb, white tinged with red, fragrant. Leaves, near stem's apex, oblanceolate, 2.5–5 Cm. (1–2′) long, 8–18 Mm. ($\frac{1}{3}$–$\frac{3}{4}$′) broad, upper portion coarsely, sharply serrate, lower cuneiform, almost entire, coriaceous, dark green, paler beneath; odor slight; taste astringent, bitter; solvents: diluted alcohol, boiling water; contains chimaphilin, tannin, arbutin, ericolon, urson, volatile oil, resin. Astringent, tonic, diuretic, rubefacient (similar to buchu, uva ursi, pareira, scoparius); scrofula, rheumatism, dropsy, scanty urine, gravel, hæmaturia, gonorrhœa, skin affections, diarrhœa, gout; ulcers, tumors. Dose, gr. 15–60 (1–4 Gm.); decoction, 5 p. c., ℥j–3 (30–90 Ml. (Cc.)); extract, gr. 3–10 (.2–.6 Gm.); fluidextract (diluted alcohol), ʒss–1 (2–4 Ml. (Cc.)); poultice.

2. *C. macula'ta, Spotted Wintergreen* (*Pipsissewa*).—The leaves, official 1830–1840; N. America. Herb, 7.5–15 Cm. (3–6′) high, leaves 2.5–5 Cm. (1–2′) long, 12 Mm. ($\frac{1}{2}$′) wide, ovate-lanceolate, obtuse at base, toothed, upper surface variegated (spotted) with white along midrib and veins; flowers purplish-white.

3. *Pyr'ola rotundifo'lia, Round-leaved Wintergreen; P. ellip'tica, Shin-leaf*, and *P. chloran'tha, Greenish-flowered Wintergreen.*—These three have racemes of nodding wax-like flowers; leaves resembling and containing same as *Chimaphila umbellata*, and used similarly.

UVA URSI. UVA URSI.

Arctostaphylos Uva-ursi, (*Linné*) *Sprengel.* — The dried leaves with not more than 5 p. c. of stems, foreign matter.

Habitat. Europe, Asia, N. America, United States, south of New Jersey, westward to California, New Mexico; rocky or sandy soil—pine woods.

Syn. Bearberry, Red Bearberry, Upland (Mountain, Wild) Cranberry, Universe Vine, Mountain Box, Bear's Grape (Bilberry, Whortleberry), Barren Myrtle, Kinnikinnick, Fox (Meal) berry; Br. Uvæ Ursi Folia; Fr. Busserole, Raisin d'Ours; Ger. Bärentraubenblätter.

Arc-to-staph'y-los. L. fr. Gr. ἄρκτος, a bear, + σταφυλή a bunch of grapes—*i. e.*, the roughness of the fruit and these berries occurring in clusters like grapes.

U'va-ur'si. L. *uva*, a grape, + *ursus, ursi*, a bear, of a bear—bear-berry—*i. e.*, berries are rough or bearish.

Plant.—Low evergreen shrub; stem creeping, young branches rising obliquely upward several inches; flowers May, 3–15 together, pinkish-white, racemes, calyx reddish, corolla urceolate, reddish-white or white with red lips; fruit autumn, 6 Mm. ($\frac{1}{4}$′) broad, fleshy, bright red berry, pericarp thick, 5-seeded, resembles currants in appearance and clusters. Leaves, obovate, oblong-spatulate, 12–30 Mm. ($\frac{1}{2}$–1$\frac{1}{5}$′) long, 5–13 Mm. ($\frac{1}{5}$–$\frac{1}{2}$′) broad, entire, slightly revolute, apex obtuse, rounded, base cuneate, tapering into short, stout petiole; dark green, glaucous, shiny, finely reticulate; under surface yellowish-green, slightly pubescent, especially on midrib, coriaceous; fracture short; odor aromatic, tea-like; taste astringent, somewhat bitter. Powder, olive-green; microscopically—irregular fragments, epidermal cells polygonal, elliptical stomata surrounded by 5–18 neighboring cells, chloroplastids, irregular masses of carbohydrates, fibro-vascular bundles, spiral tracheæ, sclerenchymatous fibres, crystal fibres, cells with yellowish-brown content, bluish-black with ferric chloride T. S. *Tests:* 1. Cover over .1 Gm. (powder) on watch-crystal with another watch-crystal, heat gently—crystalline sublimate forms, long rods, feather-like aggregates, polarizing light with brilliant colors. 2. Macerate 1 Gm. with boiling water 10 Ml. (Cc.), shake occasionally until cold, filtrate with a few drops of ferrous sulphate T. S.—grayish-purple precipitate; collect in autumn. *Solvents:* diluted alcohol; boiling water. Dose, gr. 15–60 (1–4 Gm.).

ADULTERATIONS.—*Vaccin'ium Vi'tis-Idæ'a, Wineberry, Cowberry, Red Whortleberry*—leaves resemble uva ursi, but blackish, bristly points on under surface, and *V. uligino'sum, Bog Whortleberry, Great Bilberry* — leaves crenate, much thinner, under surface pubescent; *Den'drium* (*Leiophyl'lum*) *buxifo'lium, Sand Myrtle,* N. J., southward; small shrub, leaves oval, shining, margin revolute, reticulate; *Bux'us semper'virens, Box, Bush-tree Dudgeon,* cultivated in gardens, leaves ovate, narrower toward apex than near the base; contain buxine and parabuxine (both giving bitterness), tannin, volatile oil, bitter extractive; *Epigæ'a re'pens, Trailing Arbutus* (*Mayflower, Ground Laurel, Gravel Plant*), and *Chimaphila umbellata, Pipsissewa;* leaves resemble and both contain the three active constituents of uva ursi; used in lithic acid gravel. Dose, gr. 15–60 (1–4 Gm.).

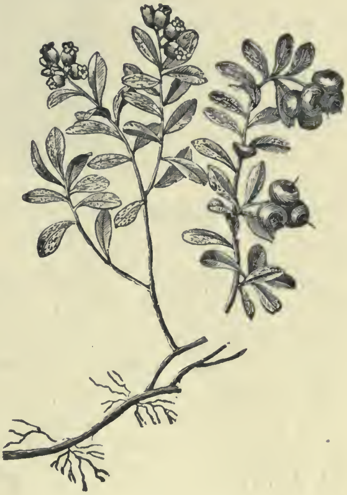


FIG. 299.—*Arctostaphylos Uva-ursi.*

CONSTITUENTS.—Arbutin, $C_{12}H_{16}O_7$, Ericolin, $C_{34}H_{56}O_{22}$, Urson, $C_{10}H_{16}O$, Tannin 6–7 p. c., ericinol, $C_{10}H_{16}O$, gallic acid, ellagic acid, coloring matter, ash 3 p. c.

Arbutin.—A glucoside obtained by precipitating the decoction with lead subacetate, treating filtrate with hydrogen sulphide, and evaporating to crystallize. It is in needles, bitter, soluble in alcohol or hot water, insoluble in ether, blue with diluted ferric chloride; with sulphuric acid yields glucose, arctuvin (hydroquinone), $C_6H_6O_2$, and methyl-hydroquinone, $C_7H_8O_2$. Dose, gr. 3–5 (.2–.3 Gm.).

Ericolin.—This is left in the mother-liquor from arbutin; it is a bitter glucoside, yellow, soluble in water, alcohol; yields glucose and ericinol (volatile oil).

Urson.—Crystalline principle, resinous, obtained by exhausting with ether, evaporating, recrystallizing from alcohol; occurs in tasteless needles, insoluble in water, sparingly in alcohol, ether.

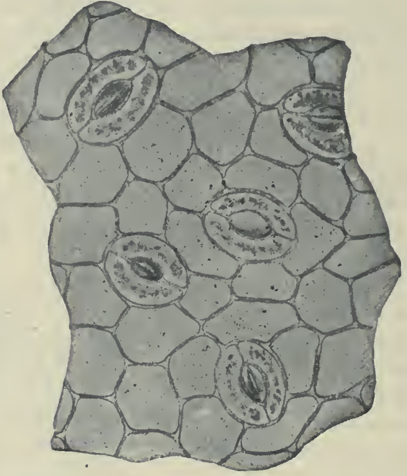


Fig. 300.—*Arctostaphylos Uva-ursi:* Piece of leaf epidermis (lower surface) showing large stomata.

Preparations.—1. *Fluidextractum Uvæ Ursi.* Fluidextract of Uva Ursi. (Syn., Fldext. Uvæ Ursi, Fluid Extract of Uvæ Ursi; Fr. Extrait fluide de Busserole; Ger. Bärentraubenblätterfluidextrakt.)

Manufacture: Similar to Fluidextractum Ergotæ, page 60; 1st menstruum: water 50 Ml. (Cc.), alcohol 30, glycerin 10; 2nd menstruum: 33 p. c. alcohol; reserve first 80 Ml. (Cc.). Dose, ♏xv–60 (1–4 Ml. (Cc.)).

Unoff. Preps.: Decoction, dose, ℥j–2 (30–60 Ml. (Cc.)). *Extractum Uvæ Ursi* (alcohol 30 p. c.), dose, gr. 5–15 (.3–1 Gm.). *Infusum Uvæ Ursi* (Br.), 5 p. c., dose, ℥ss–2 (15–60 Ml. (Cc.)).

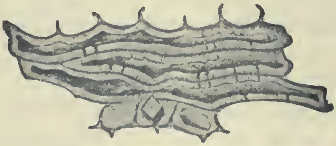


Fig. 301.—*Arctostaphylos Uva-ursi:* Bast-fibres and parenchyma from part of leaf without chlorophyll, containing a single crystal.

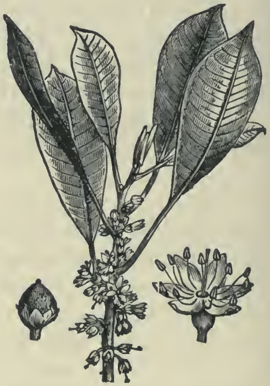


Fig. 302.—*Palaquium Gutta.*

Properties.—Astringent, diuretic, nephritic, tonic, disinfectant (due to the hydroquinone formed); large doses vomit, purge, oxytocic.

Uses.—Cystitis, gravel, chronic nephritis, urethritis, incontinence of urine, dysuria, strangury, uterine hemorrhage, gleet, leucorrhœa, menorrhagia, urinary calculi, bronchitis, diarrhœa, cardiac dropsy.

Allied Plants:

1. *Arctostaphylos glau'ca, Manzanita.*—California mountains, small tree; leaves 5 Cm. (2′) long; contains arbutin, tannin 10 p. c., ash 6 p. c. *A. polifo'lia* and *A. mucrocif'era,* Mexico; both used like uva ursi.

2. *Kal'mia latifo'lia, Mountain Laurel, Calico-bush.*—About 1.8–9 M. (6–30°) high; flowers inodorous, May–June; leaves evergreen, elliptical; contains tannin, arbutin, resin, andromedotoxin, $C_{31}H_{51}O_{10}$. Astringent; large doses poisonous.

3. *Limo'nium carolinia'num* (*Stat'ice Limo'nium* var. *carolinia'na*), *Marsh Rosemary.*—Plumbaginaceæ. The root, official 1820–1880; N. America. Plant a maritime perennial, acaulescent; leaves 2.5–4 Cm. (1–$1\frac{3}{5}$′) long, obovate, cuneiform, entire, mucronate, scape .3–.6 M. (1–2°) high, terete, corymbose panicles; flowers lavender color; root .3–.6 M. (1–2°) long, 2.5 Cm. (1′) thick, annulate, wrinkled, purplish-brown, astringent, bitter; contains tannin 14–18 p. c., volatile oil, resin. Used as astringent like catechu or kino for aphthous and ulcerative affections of the mouth, fauces, hemorrhages, dysentery; in decoction, infusion, tincture. Dose, gr. 5–30 (.3–2 Gm.).

4. *Pala'quium Gut'ta,* and *P. oblongifo'lium, Gutta-percha*—Sapotaceæ. Concrete exudation, official 1880–1890; Malayan Peninsula and Islands, Singapore, Borneo. Tree, 18–21 M. (60–70°) high, .6–1 M. (2–3°) thick; bark reddish-gray; leaves 10–12.5 Cm. (4–5′) long, tomentose, silky beneath; flowers yellowish. Gutta-percha is obtained by incisions, or by felling trees, removing bark, and catching juice in plantain-leaf stalks, palm leaves, or cocoanut shells; it soon coagulates and occurs in yellowish, grayish masses, hard, heavier than water, flexible, plastic at 50° C. (122° F.), decomposes on melting; inodorous; tasteless; soluble in ether, chloroform, oil of turpentine, carbon disulphide; contains gutta, $C_{20}H_{32}$, 80 p. c., fine white powder; fluavil, $C_{20}H_{32}O$, yellow resin; albane, $C_{20}H_{32}O_2$, white resin. Used in surgery for splints, catheters, bougies, specula, pessaries, syringes, etc. *Liquor Guttæ Perchæ,* official 1880–1890, 15 p. c., + lead carbonate 17, chloroform q. s. 100; employed as an adhesive and protective agent for wounds, abrasions, skin affections, sore nipples, erysipelas, smallpox, etc.

5. *Dios'pyros virginia'na, Persimmon.*—Ebenaceæ. The unripe fruit dried, official 1820–1880; United States. Tree, 6–21 M. (20–70°) high, much smaller northward; wood hard, blackish; leaves 7.5–12.5 Cm. (3–5′) long, entire, glaucous beneath, elliptical; flowers yellowish; fruit plum-like, 2.5 Cm. (1′) thick, green, 4-lobed calyx at base; short style at apex, 6-celled, 6-seeded; taste astringent, when ripe orange-red, by frost sweet, edible; contains tannin, malic acid. Used as astringent for diarrhœa, chronic dysentery, uterine hemorrhage, leucorrhœa, sore throat; in infusion, tincture, syrup. Dose, gr.

15–60 (1–4 Gm.). Persimmon beer, made by fermenting ripe fruit with hops, as a beverage, and the bark as tonic and astringent, are popular to some extent.

55. STYRACACEÆ. Storax Family.

Sti-ra-ka′se-e. L. *Styr-ax*(*ac*) + aceæ, Gr. *στύραξ*, a tree yielding gum, an alteration of native Ar. name *Assthirak.* Trees, shrubs. Distinguished by yielding stimulant balsamic resins; calyx 4–8-cleft, inferior; corolla 4–8-lobed; stamens equal or twice the petals, united at base; ovary 2–5-celled, each 1-seeded, style 1; fruit, berry or drupe, fleshy; tropics, temperate climates; stimulant; resins, dyes.

Genus: **1. Styrax.**

BENZOINUM. BENZOIN.

Styrax Benzoin, *Dryander,* and other species. } The balsamic resin.

Habitat. East Indies—Sumatra, Siam, Java, Borneo, Malay Peninsula, Laos; cultivated; grown upon interior hills and sea coast plantations.

Syn. Gum Benjamin, Benzoin Laurel, Benjamin tree, Resina Benzoe, Asa Dulcis; Fr. Benjoin (de Sumatra); Ger. Benzoë, Benzoe.

Sty′rax. L. see etymology, above, of Styracaceæ.

Ben-zo-i′num. L. fr. Ar. *luban, jawa,—lu* + *ban* + *join*, contracted, lit., "incense of Java," in universal use.

Ben-zo′in. The original word and mostly used.

Plant.—Handsome tree, medium height, with dense spreading crown; bark grayish, tomentose; leaves oblong, downy, 7.5–12.5 Cm. (3–5′) long, acuminate, dentate; flowers inside reddish, outside white, hairy, anthers 2-celled. Balsamic resin (benzoin): *Sumatra,* in blocks, lumps of variable size made up of tears compacted together with reddish-brown resinous mass; tears yellowish-brown, fresh fracture milky-white; hard, brittle, softened by heat; odor aromatic, when boiled with water suggesting cinnamic acid or storax; taste aromatic, slightly acrid—gritty on chewing; *Siam,* in pebble-like tears of variable size, compressed, yellowish-brown, separate or slightly agglutinated, fracture milky-white, hard, brittle, softened by heat; odor agreeable, balsamic, vanilla-like; taste slightly acrid—plastic on chewing. *Tests:* 1. Alcohol dissolves 75 (Sumatra)–90 (Siam) p. c., the solution being acid, and milky with water. 2. Heat fragments in test-tube—sublimate formed just above melted mass, in plates, small rod-like crystals strongly polarizing light (Sumatra), or in long rod-shaped crystals slightly polarizing light (Siam). 2. Ethereal solution added to small quantity of sulphuric acid—brownish-red (Sumatra), purplish-red (Siam). *Impurities:* Rosin, foreign resins, etc. Dose, gr. 5–30 (.3–2 Gm.).

Adulterations.—Wood, bark, splinters, earthy matter, stones, resinous matrix (in cake benzoin—remaining behind when treated with alcohol or sublimed), 10–40 p. c.

Commercial.—Trees contain no resin-receptacles and only the unhealthy afford resin—a pathological product (tannate transformation resulting from wounding)—which is obtained, July–Nov., from both wild and cultivated plants over 6 years old having a trunk 15–20 Cm. (6–8′) thick, by making between the ground and the first branches longitudinal or oblique incisions, or a circle of notches through the bark into which the white liquid resin slowly exudes; after 3 months, when dry and hard (concreted), it is picked out, cut or scraped off with knives or sharp sticks, placed into baskets, and assorted according to size, cleanness, and quality, the larger tears (marbles, almonds) commanding the higher price. Each tree yields annually about 3 pounds (1.5 Kg.) for 12 years, when they are cut down; the first 3 years' product, called natively *head benzoin*, is best, being more fragrant and filled with white tears; the next 7–8 years' yield, *belly benzoin*, is browner, with less white tears, while by felling the trees and splitting the stems an inferior quality, *foot benzoin*, "*foots*," is scraped off, being dark and mixed with wood, bark, etc. These names correspond to our *superior*, *medium*, *inferior*—both having the same relative values, 105, 45, 18. It is received at the Sumatra ports in cakes wrapped in matting, there softened by heat, packed into chests, and sent to Penang and Singapore, thence into commerce; in Siam it is conveyed on bullocks' backs to Menam River, thence via Bangkok to market in cubical blocks. There are five varieties: 1, *Sumatra*, grayish-brown, with many white tears mixed with resinous matrix of unknown origin, reddish-brown with age; 75 p. c. soluble in alcohol odor weak, storax-like; inferior kinds with few or no tears, but many chips of wood, bark, etc., especially in the centre—"drossy" or "false

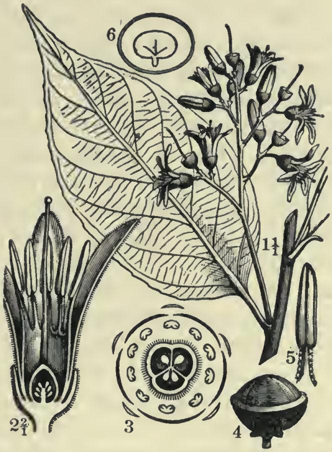


Fig. 303.—*Styrax Benzoin: 1*, flowering twig; *2*, vertical section of flower; *3*, diagram of the flower; *4*, fruit, with upper portion laid bare, showing channeled surface; *5*, anther; *6*, seed, longitudinal section.

packed;" 2, *Siam*, best, reddish-brown, in small or large tears; 90 p. c. soluble in alcohol, odor strongest, most agreeable, vanilla-like, taste bitter; occurs in two forms: (*a*) tears—almond-shaped lumps, often 2.5 Cm. (1′) long, more or less flattened; (*b*) amygdaloid—tears agglutinated with reddish-brown matrix; 3, *Penang*, similar to Sumatra, but odor even more storax-like, and possibly from other species of *Styrax;* 4, *Palembang*, free from tears, pale reddish-brown, opalescent lustre (due to moisture, becoming moldy), little odor; contains benzoic acid, no cinnamic acid nor vanillin; tincture gives flocculent precipitate, not milkiness, in water; seldom reaches our market; 5, *False* (*Catappa —Bu'ceras* (*Termina'lia*) *angustifo'lius*—Combretaceæ); whitish-brown aromatic exudate obtained by incisions; resembles benzoin slightly; used as incense in E. India. While the quality of all varieties depend upon the amount of tears, yet the Sumatra is the great article of commerce, although the Siam is purest, least variable, and best flavored.

CONSTITUENTS.—Sumatra: Benzoic acid, 10–20 p. c., Cinnamic acid, small amount or wanting, Resins, Vanillin .1–1 p. c. volatile oil (benzoic acid ester—aromatic, neutral). 3 p. c., styracin 2–3 p. c., styrol, benzaldehyde, phenyl-propyl cinnamate, 2 esters 75 p. c. (of which 92.6 p. c. is resinotannol, 7.4 p. c. benzoresinol)—yielding cinnamic acid 33 p. c.; Siam: less benzoic acid, little or no cinnamic acid, more vanillin, 1–1.5 p. c., benzoresinol benzoate, $C_{16}H_{26}O$, 5 p. c. (long white prisms), resinotannol benzoate, $C_{12}H_{14}O_3$, 57 p. c., ash 2 (Sumatra) –2.5 (Siam) p. c.

Acidum Benzoicum. Benzoic Acid, $HC_7H_5O_2$, *official.*—(Syn., Acid. Benz., Acidum Benzoicum Sublimatum, Flores Benzoes, Flowers of Benzoin; Fr. Acide benzoïque, Fleurs de Banjoin; Ger. Benzoesäure, Benzoeblumen.) It is an organic acid which may be obtained (*wet process*) by boiling benzoin several hours with milk of lime, filtering while hot, supersaturating filtrate with hydrochloric acid, allowing to crystallize, purifying; or more frequently (*dry process*) by the sublimation of benzoin (sometimes having an equal weight of sand added) between the temperatures 140–180° C. (284–366° F.). It is made also from hippuric acid (horse and cattle urine, furnishing the *German benzoic acid*), as well as synthetically from phthalic acid (naphthalene), but chiefly for commercial purposes, artificially from toluene (tolulol), $C_6H_5CH_3$, by passing chlorine into it (boiling) until ceasing to gain weight, thereby converting it first into benzo-trichloride, and then treating this with water under pressure—$C_6H_5CCl_3 + 2H_2O = C_6H_5\text{-}COOH + 3HCl$; it is in lustrous scales, friable needles; natural—white, yellowish, darker on exposure to light, slight odor of benzoin; synthetic —white, odorless, slight odor of benzaldehyde; pungent acid taste, somewhat volatile at moderate temperature, freely with steam; soluble in water (275), boiling water (18), alcohol (2.3), boiling alcohol (1.5), chloroform (4.5), ether (3), benzene (10), oil of turpentine (23), solutions of alkali hydroxides, fixed and volatile oils; melts at 120° C. (248° F.); saturated solution acid; contains 99.5 p. c. of C_6H_5COOH; the sublimed is most soluble in water and contains volatile oil imparting odor. *Tests:* 1. Neutralize an alkali hydroxide solution, + ferric chloride T. S. (previously diluted with distilled water (2) and neutralized, if necessary, with ammonia water)—pink precipitate (ferric benzoate). 2. Incinerate 2 Gm.—ash .05 p. c. *Impurities:* Chlorine, cinnamic acid, readily carbonizable substances. Should be kept cool, dark, in well-closed containers. Dose, gr. 5–15 (.3–1 Gm.).

Cinnamic Acid, $C_9H_8O_2$.—Obtained by agitating filtered ethereal solution with weak sodium hydroxide solution (to remove benzoic acid and vanillin), distilling off ether, saponifying pure esters by boiling with sodium hydroxide solution several hours, acidifying, boiling, filtering, cooling, when crystals appear. The two acids may be separated by their different degree of volatility, benzoic acid melting at 121.4° C. (250.5° F.) and the two mixed (1 cinnamic, 2 benzoic) at 25.5° C. (78° F.).

Resins.—One is extracted along with benzoic acid by boiling solution of potassium carbonate in excess; another is dissolved from the residue by ether, while the third is affected by neither solvent, hence left as a residue. With melted potassium hydroxide get paroxybenzoic acid, $C_7H_6O_3$, protocatechuic acid, $C_7H_5O_4$, and pyrocatechin, $C_6H_6O_2$.

Vanillin, $C_8H_8O_3$.—Is obtained by treating Siam benzoin with caustic lime, precipitating benzoic acid with hydrochloric acid and shaking liquid with ether.

PREPARATIONS.—I. BENZOIN: 1 *Adeps Benzoinatus.* Benzoinated Lard. (Syn., Adeps Benz., Benzoated Lard, Unguentum Benzoini, Axungia Balsamica—Benzoinata or Benzoata; Br. Adeps Benzoatus; Fr. Axonge benzoinée; Ger. Adeps Suillus Benzoinatus, Benzoe (Benzoinirtes)-schmalz.)

Manufacture: 1 p. c. Mix thoroughly Siam benzoin 1 Gm., in coarse powder, with lard 100 Gm., heat gently on water-bath for 2 hours, stirring frequently, strain, stir while cooling; when for hot-weather use, may replace 5 p. c. (or more) of the lard by white wax. Should be kept cool, in well-closed containers impervious to fat.

Preps.: 1. *Ceratum,* 70 p. c. 2. *Ceratum Cantharides,* 20 p. c. 3. *Unguentum,* 80 p. c. 4. *Unguentum Belladonnæ,* 55 p. c. 5. *Unguentum Chrysarobini,* 94 p. c. 6. *Unguentum Hydrargyri,* 25 p. c. 7. *Unguentum Iodi,* 80 p. c. 8. *Unguentum Iodoformi,* 90 p. c. 9. *Unguentum Stramonii,* 65 p. c. 10. *Unguentum Sulphuris,* 85 p. c. 11. *Unguentum Zinci Oxidi,* 80 p. c.

2. *Tinctura Benzoini.* Tincture of Benzoin. (Syn., Tr. Benz.; Fr. Teinture de Benjoin; Ger. Benzoëtinktur.)

Manufacture: 20 p. c. Similar to Tinctura Aloes, page 110; menstruum: alcohol. Dose, ʒss–1 (2–4 Ml. (Cc.)); largely externally.

3. *Tinctura Benzoini Composita.* Compound Tincture of Benzoin. (Syn., Tr. Benz. Co., Friar's or Turlington's Balsam, Tinctura Balsamica, Balsamum Commendatoris, Elixir Traumaticum; Fr. Teinture balsamique, Baume du Commandeur de Permes; Ger. Persischer Wundbalsam.)

Manufacture: 10 p. c. Similar to Tinctura Aloes, page 110—using benzoin 10 Gm., aloes 2 Gm., storax 8 Gm., balsam of tolu 4 Gm.; menstruum: alcohol. Dose, ʒss–1 (2–4 Ml. (Cc.)); mostly externally.

II. Benzoic acid: 1. *Tinctura Opii Camphorata,* $\frac{2}{5}$ p. c.

Unoff. Prep.: Trochiscus Acidi Benzoici (Br.), each $\frac{1}{2}$ gr. (.03 Gm.).

Properties.—Stimulant, expectorant, antiseptic, diuretic, antipyretic. It is eliminated slightly by the skin, salivary glands, and broncho-pulmonary mucous membrane, but mostly by the kidneys, where it is converted into hippuric acid, which renders alkaline urine acid, increases the flow, disinfects and stimulates the genito-urinary tract.

Uses.—Chronic laryngitis, diarrhœa, dysentery. Locally the tincture as a stimulant and protective to wounds, to arrest coryza. Benzoic acid—for bronchitis, uric acid deposits, cystitis, acute gonorrhœa, phosphatic gravel, incontinence of urine, rheumatism, Bright's disease, albuminuria, dressing to wounds, ulcers.

Incompatibles: The tinctures with all aqueous preparations.

56. OLEACEÆ. Olive Family.

O-le-a′se-e. L. *Òle-a* + aceæ, Gr. ἐλαία, olive tree, ἔλαιον, *oleum,* oil—*i. e.,* referring to the oleaginous fruit. Trees, shrubs. Distinguished by stamens 2–4, inserted on corolla; ovary 2-celled, superior; ovules 2 in each cell; calyx and corolla 4–8-cleft, regular; fruit capsule, samara, berry or drupe, often 1-seeded; temperate climates, tropics; tonic, febrifuge, purgative, perfumery (vol. oil), fragrant flowers; hardwood, dye.

Genera: **1. Olea. 2. Fraxinus.**

OLEA. OLIVE.

Oleum Olivæ. Olive Oil, *official.*

Olea europæa, *Linné.* } A fixed oil obtained from the ripe fruit.

Habitat. Asia, S. Europe (Spain, Portugal, Asia Minor, Syria, Italy, S. France), Algeria; cultivated in S. United States (Fla., Cal.), S. America.

Syn. Olive Gum, Lucca Gum, Olive (Bark) Leaves; Ol. Oliv., Sweet Oil; Fr. Huile d'Olive; Ger. Oleum Olivarum, Olivenöl.

O′le-a. L. olive, fr. Gr. ἐλαία, olive tree, *oliva,* the fruit, *oleum,* the juice or oil from the fruit.

Eu-ro-pæ′a. L. European—*i. e.,* its habitat.

Plant.—When wild a branched, thorny shrub; under cultivation a tree 3–9 M. (10–30°) high, resembling white willow; bark grayish-white; leaves 5–6 Cm. (2–2$\frac{2}{5}$′) long, lanceolate, acute, entire, coriaceous, glabrous, upper side glaucous-green, the lower silvery-white; flowers many, small, creamy-white, diandrous, racemes; fruit drupe, 12–25 Mm. ($\frac{1}{2}$–1′) long, ovoid, pointed, olive-green then deep purple, sarcocarp firm, fleshy, internally greenish and filled with oil; stone (putamen) thick, bony, ovoid, 1-seeded.

Constituents.—Fruit sarcocarp: Fixed oil 70 p. c., water 25 p. c.

Oleum Olivæ. Olive Oil.—It is a pale yellow, light greenish-yellow, oily liquid, slight peculiar odor and taste, faintly acrid after-taste; slightly soluble in alcohol, miscible with ether, chloroform, carbon disulphide; sp. gr. 0.915; cooled from 10–8° C. (50–46° F.) somewhat cloudy from separation of crystalline particles, at 0° C. (32° F.) forms whitish, granular mass; contains olein 70 p. c., linolein 6 p. c., palmitin and arachin 28 p. c., phytosterin (unsaponifiable matter, once thought to be cholesterin), chlorophyll (from fruit, imparting greenish color). *Tests:* 1. Mix in test-tube 5 Ml. (Cc.) with 5 Ml. (Cc.) of equal vols. of amyl alcohol and carbon disulphide, containing 1 p. c. of sulphur in solution, immerse to one-third its depth in boiling, saturated aqueous salt solution —no reddish color in 15 minutes (abs. of cottonseed oil). 2. Mix 2 Ml. (Cc.) with 1 Ml. (Cc.) of hydrochloric acid containing 1 p. c. of sugar, shake half a minute, let stand 5 minutes, add 3 Ml. (Cc.) of distilled water, shake—acid layer shows no pink color (abs. of sesame oil). Should be kept cool, in well-closed containers. Dose, adult, ℥ss–1 (15–30 Ml. (Cc.)); infant, ʒj–2 (4–8 Ml. (Cc.)), in emulsion.

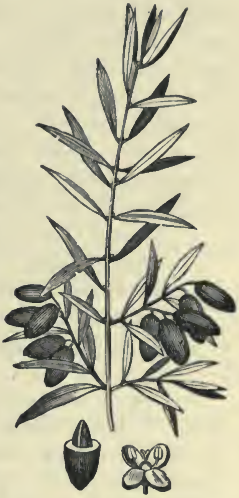


FIG. 304.—*Olea europæa.*

ADULTERATIONS.—Chiefly cottonseed oil, also peanut, poppy, rape, and sesame oils, etc., rarely less than 25 p. c.; all of these congeal at much lower temperature, and do not solidify when shaken with mercuric nitrate (12), as does pure olive oil.

Commercial.—Tree is grown successfully in California, but our supply of oil comes solely from Europe, it being obtained by crushing ripe fruit short of the putamen, subjecting marc, in coarse bags, to strong pressure, and running oil into vessels containing water, from which, after a few days subsidence, it is skimmed, thus constituting the first grade, *huile vierge—virgin oil;* the press-cakes are taken from the bags, finely broken up with hot water, and subjected to greater pressure, thereby removing both water and oil, the latter being drawn off from the surface, constituting *second-grade oil;* the remaining marc contains 9–12 p. c. of oil, which may be extracted by carbon disulphide, or by mixing with hot water in cisterns (enfer), and allowing partial fermentation, yielding on the surface a disagreeably smelling oil, *huile d'enfer;* sometimes inferior fruit is allowed to ferment in heaps or vats, giving by expression also an inferior oil, *huile fermentée.* In order to combine perfume, fineness, and sweetness the oil must be from fruit slightly ripe, and then stored 6–8 months, until the strong flavor has disappeared; it enters commerce in bottles, jugs, and barrels, under the brands: Province, Florence, Gallipoli, Spanish, Sicily—the best from S. France, the most from Italy (one-half), and Spain (one-fifth).

PREPARATIONS.—1. *Sapo.* Soap. (Syn., White Castile Soap, Sodium Oleate, Sapo Durus, Hard Soap; Fr. Savon Médicinæ, Savon blanc d'Espagne; Ger. Sapo medicatus—(hispanicus), Medizinische Seife, Seife, Spanische Seife.)

Manufacture: Olive oil and sodium hydroxide are boiled together until saponified—$C_3H_5(C_{18}H_{33}O_2)_3 + 3NaOH = 3NaC_{18}H_{33}O_2$ (hard soap) + $C_3H_5(OH)_3$. It is a white, whitish solid (in bars), hard, yet easily cut when fresh, or a fine, yellowish-white powder, faint, peculiar odor, free from rancidity, disagreeable, alkaline taste; soluble in water, alcohol, more readily with heat; aqueous solution alkaline. *Impurities:* Water, soap from animal fats, sodium hydroxide, sodium chloride, sodium carbonate, silica, metallic and other accidental substances.

Prep.: 1. *Linimentum Saponis.* Soap Liniment. (Syn., Lin. Sapon., Liquid Opodeldoc, Tinctura Saponis Camphorata, Spiritus Nervinus Camphoratus; Fr. Liniment savonneux camphré; Ger. Linimentum saponato-camphoratum, Opodeldok.)

Manufacture: 6 p. c. Dissolve camphor 4.5 Gm., oil of rosemary 1 Ml. (Cc.) in alcohol 70 Ml. (Cc.), add soap 6 Gm., water q. s. 100 Ml. (Cc.); agitate until soap dissolved, set in cool place for 24 hours, filter; used externally.

Prep.: *Linimentum Chloroformi,* 70 p. c.

2. *Extractum Colocynthidis Compositum,* 15 p. c. 3. *Pilulæ Aloes,* 2 gr. (.13 Gm.). 4. *Pilulæ Asafœtidæ,* 1 gr. (.06 Gm.).

2. *Emplastrum Plumbi.*

Unoff. Preps.: Camphorated Soap Liniment (Solid Opodeldoc), monohyd. sodium carbonate 1, stearic acid 5, water 10, camphor 2.5, oil of thyme .3, oil of rosemary .6, ammonia water 5, alcohol 80. *Pilula Saponis Composita* (Br.), 60 p. c. + opium 20 + syrup of glucose 20, dose, gr. 2–4 (.13–.26 Gm.). *Sapo Animalis, Curd Soap* (Br.).

PROPERTIES.—Nutritious, demulcent, emollient, laxative, protection to mucous membrane against acrid or poisonous substances; it increases secretion of bile, peristalsis, and dissolves cholesterin, the chief constituent of gall-stones. Like other oils, it is partly emulsified and saponified in the intestines, its glycerin being set free, and fatty acid combining with free alkalies to form soap, which with the emulsion forms molecular basis of the chyle; it enters the blood through the lacteals, being finally oxidized into carbon dioxide and water. Soap has same properties.

USES.—Gall-stones, cantharides and other poisoning, infantile constipation in enema. Externally—burns, skin inflammations, to protect from air, insect-bites, stings, bruises, sprains, wounds, engorged mammæ, rectal ascarides; facilitates removal of crusts, scales, etc., and introduction of bougies, catheters, pessaries, sounds, specula; to lubricate machinery, in making liniments, plasters, cerates, ointments, etc.

Allied Products:

1. *Olive Gum, Lecca Gum.* Resinous substance which exudes spontaneously from the trees. 2. *Leaves* and *young bark;* used externally

as astringents, antiseptics; internally as tonics in intermittents. 3. *Olive Wood;* has beautiful veins, pleasant odor, capable of fine polish, highly esteemed for backs of brushes, boxes, and in cabinet-work. 4. *Olive Fruit;* as a dessert—for this the unripe fruit is steeped repeatedly in water containing lime and ashes, then bottled in a slightly aromatic, concentrated salt solution; the small French or Provence and the large Spanish olives are used for this purpose.

MANNA. MANNA.

Fraxinus Ornus, *Linné.* } The dried saccharine exudation.

Habitat. Mediterranean Basin, Asia Minor to Spain; Sicily, France, Italy.

Syn. Manna (Flowering) Ash, European Manna Tree; Fr. Manne en Larmes; Ger. Manna.

Frax′i-nus. L. for ash tree, fr. Gr. *φράσσω—ξω*, to fence in, enclose—*i. e.*, the wood used for making hedges or fences, thus protecting things and places.

Or′nus. L. Wild Ash, fr. Heb. *oren*, Gr. *ορείνος*—*i. e.*, the classic name for wild mountain ash.

Man′na. L. fr. Gr. *μάννα*, Heb. *man*, Ar. *mann*, gift (of heaven)—divinely supplied food—*i. e.*, to the Israelites in their journey through the wilderness of Arabia.

Plant.—Small tree, 4.5–7.5 M. (15–25°) high; stem slender, bark gray, with leaf-scars on young twigs; leaves imparipinnate, 15–20 Cm. (6–8′) long; leaflets 4 pairs, 2.5–5 Cm. (1–2′) long, oval, acuminate, serrate, bright green, petiolate; flowers May–June, small, numerous, white, panicles, petals, 4 Mm. ($\frac{1}{6}$′) long; fruit samara, 2.5 Cm. (1′) long, 4 Mm. ($\frac{1}{6}$′) broad. Exudation (manna), in irregular, more or less elongated, flattened, 3-sided pieces, yellowish-white, friable, somewhat waxy; internally nearly white, porous and crystalline in appearance; odor slight, characteristic; taste sweet, slightly bitter, faintly acrid; also in irregular masses, partly brittle or soft, resin-like fragments, yellowish-white, yellowish-gray—the latter at least, to the extent of 40 p. c. *Test:* 1. Heat to boiling 5 Gm. with alcohol 100 Ml. (Cc.)—filtrate on cooling rapidly deposits crystals of mannite. *Solvents:* hot or cold water; alcohol. Dose, ℥j–8 (4–30 Gm.).

Adulterations.—Products of allied species, bread crumbs, starch, glucose, wood, bark, etc.

Commercial.—The manna ash was introduced into Europe, 1710, and is so graceful as to be planted often in gardens for ornament. In Sicily whole plantations are cultivated for the juice, which is obtained from trees, at least 8 years old and stem 7.5–10 Cm. (3–4′) thick, by cutting through the bark to the wood with a curved knife transverse incisions, 2.5–5 Cm. (1–2′) long, and 2.5 Cm. (1′) apart, the first cut being nearest the ground, and another made directly above it every day during warm weather, July–August. The next year another portion of the stem is used, so continuing 10–12 seasons, when the trees, being spent, are felled and shoots allowed to spring from the stump. Manna exudes from these incisions as a clear liquid, soon concretes on the stem, or on sticks and straws placed in the incisions for the purpose, is dried upon shelves, and packed for market in tin-lined deal boxes having partitions. There are three varieties:

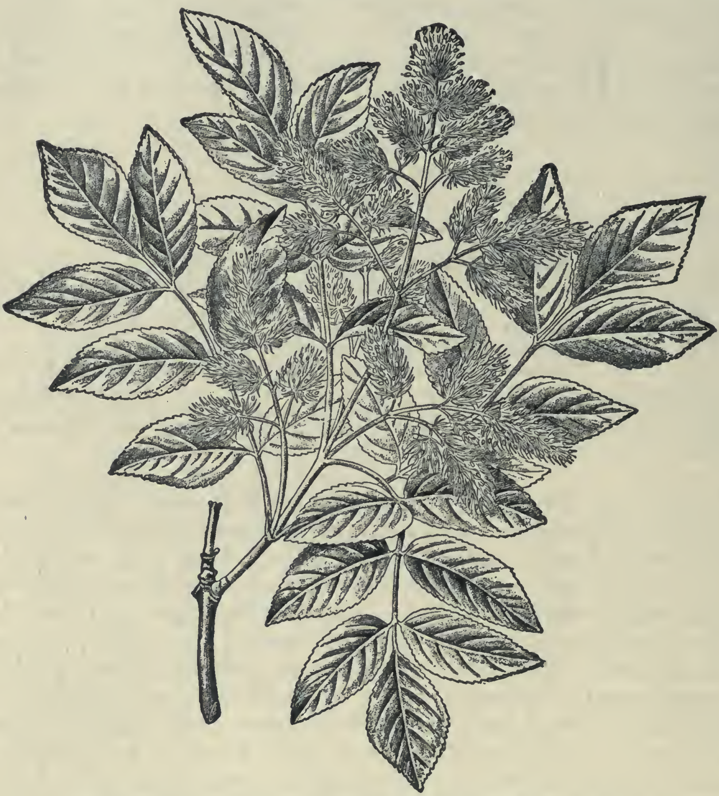


Fig. 305.—*Fraxinus Ornus:* branch showing leaves and flowers.

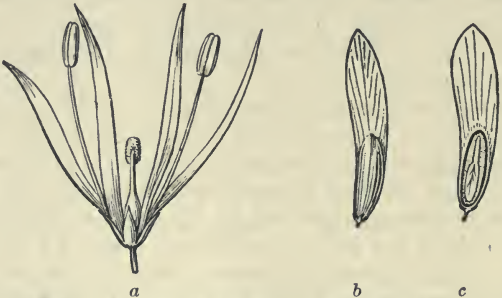


Fig. 306.—*Fraxinus Ornus:* *a*, flower opened; *b*, single-winged fruit; *c*, longitudinal section of same.

1. *Large Flake* (*Manna Cannellata, Electa*), obtained when juice abundant from upper incisions, giving a product less fatty, in conse-

quence of which it dries easily in tubes or flat pieces—the very best, *Manna a cannola*, on sticks, straws inserted in the cuts, being unknown in our market; 2, *Small Flake* (*Manna in tears, lachrymis*), same as preceding, only smaller and often of darker shade; 3, *Sorts* (*Tolfa, Manna Communis*), in tears from lower incisions, into which leaves, etc., are placed for it to congeal upon; it is inferior, more gummy, sticky, brownish, internally whitish, less crystalline, some being scraped from trees; 4, *Fat* (*Manna Pinguis*), flows down the trunk, Oct.–Nov., fragments united by brown viscid matter, without flakes; rarely seen in market or used in medicine.

CONSTITUENTS.—Mannite 60–90 p. c., Glucose, mucilage, fraxin, resin.

Mannite, $C_6H_8(OH)_6$.—Obtained with boiling alcohol and recrystallizing from the same several times; occurs in white prisms, soluble in water (6), slightly in absolute alcohol, insoluble in ether, by oxidation gives fermentable mannitose and various acids.

Glucose.—Sometimes 16 p. c. **Mucilage** and **Fraxin,** $C_{22}H_{36}O_{20}$, are mostly in inferior grades; to this latter are due the fluorescence of the aqueous solution and the green color seen in some manna.

PREPARATIONS.—1. *Infusum Sennæ Compositum*, 12 p. c. Dose, ℥j–3 (30–90 Ml. (Cc.)).

Unoff. Prep.: Syrup, 12.5 p. c., + sugar 77.5, alcohol 6.5, water q. s. 100, dose, ʒj–2 (4–8 Ml. (Cc.)).

PROPERTIES.—Laxative, demulcent, expectorant, cholagogue, may cause flatulence and colic; action slow and constringes secondarily.

USES.—Usually given with other medicines, as senna, rhubarb, magnesium oxide, neutral salts, etc., to which it adds purgative properties, and by its sweetness disguises disagreeable taste of its associate. Useful in piles, genito-urinary irritation, constipation of pregnancy. Mostly given to children and delicate persons, to whom its sweetness appeals.

Allied Products:

1. *Fraxinus excel'sior, European Ash.*—S. Europe. Produces manna identical with the official.

2. *La'rix Larix* (*europæa*), *Briançon Manna* (Pinaceæ); *Quercus Vallo'nea, Armenian Manna* (Fagaceæ); *Alha'gi camelo'rum, Persian Manna* (Papilionaceæ); *Eucalyptus gonioca'lyx, E. Gun'ni* and *E. vimina'lis* (Myrtaceæ); *Tam'arix mannif'era, Tamarisk Manna* (Tamaricaceæ). All these produce sweet exudations or mannas (not met in commerce), containing melezitose, $C_{12}H_{22}O_{11}3H_2O$, or melitose, $C_{12}H_{28}O_{14}$, or some such saccharine principle. The saccharine products of some insects as *Trehala*, cocoon of *Lavi'nus mellif'icus* (Syria) and *Lerp*, upon *Eucalyptus dumosa* (Australia) contain trehalose sugar, and are used as manna.

Allied Plants:

1. *Fraxinus america'na, Fraxinus, White Ash Bark.*—United States; tree 18–24 M. (60–80°) high, durable, tough wood, 5–9 ovate, acuminate leaflets, terete fruit, 2.5–5 Cm. (1–2′) long, abruptly dilated into wedge-linear wing. Dried bark, deprived of corky layer—in

flat pieces 3–6 Mm. ($\frac{1}{8}$–$\frac{1}{4}$′) thick, yellowish, warty, inside pale brown, striate, odor faintly aromatic, taste bitter, acrid; contains volatile oil, resin, tannin, alkaloid (?), ash 10 p. c. Diuretic, diaphoretic, purgative; gout, rheumatism, intermittents. Dose, gr. 30–60 (2–4 Gm.); infusion, 5 p. c., ℥ss–1 (15–30 Ml. (Cc.)).

2. *Chionan′thus virgin′ica, Chionanthus, Fringe Tree Bark, Flowering Ash, Old Man's Beard.*—S. United States, river banks; low tree or shrub, very ornamental in cultivation; leaves 5–6, oblong, fruit purple ovoid drupe, 1–2 Cm. ($\frac{2}{5}$–$\frac{4}{5}$′) long. Dried bark of root—curved pieces, quills, 1–10 Cm. ($\frac{2}{5}$–4′) long, 2–10 Mm. ($\frac{1}{12}$–$\frac{2}{5}$′) thick, some pieces sink in water, reddish-brown, wrinkled, whitish cork, inside yellowish, striate, fracture short, hard, granular (stone cells); contains bitter principle, tannin, ash 5 p. c.; solvents: water, alcohol. Alterative, blood purifier; liver trouble, syphilis; popular with Eclectics, Homeopaths. Dose, gr. 15–30 (1–2 Gm.), decoction, infusion, 5 p. c., ℥ss–1 (15–30 Ml. (Cc.)).

57. LOGANIACEÆ. Logania Family.

Lo-ga-ni-a′se-e. L. *Logani-a* + aceæ, after J. Logan, a noted botanist. Shrubs, herbs, trees. Distinguished by poisonous properties; leaves entire, stipulate or raised stipular line; calyx 4–5-cleft, inferior; corolla 4-, 5-, 10-cleft, regular; stamens epipetalous, 4, 5, 10; ovary 2-, 3-, 4-celled, superior; fruit capsule or drupe. Connects Gentianaceæ, Apocynaceæ, Scrophulariaceæ (from which differentiated by having stipules), and Rubiaceæ (which has no free ovary); tropics; nervine, tonic, anthelmintic, poisonous.

Genera: **1. Gelsemium. 2. Spigelia. 3. Strychnos.**

GELSEMIUM. GELSEMIUM.

Gelsemium sempervirens, (*Linné*) *Aiton filius.* } The dried rhizome and roots.

Habitat. United States, southward, Va. to Fla., Ala.; rich, moist soil—woodlands.

Syn. Gelsem., Yellow Jasmine Root, Yellow Jassamine, Wild or Carolina Jassamine, Woodbine, Evening Trumpet-flower; Br. Gelsemii Radix; Fr. Jasmin sauvage; Ger. Gelsemie, Giftjasmin, Gelber Jasmin.

Gel-se′mi-um. L. *gesmino, gelsomino,* jasmine, altered from *gelseminum,* a form of *jasminum,* all medieval names for the jasmines (or jassamines), with which this was classed.

Sem-per′vi-rens. L. *semper,* always, + *viren(t)s,* ppr. of *virere,* to be green, evergreen—*i. e.,* the leaves.

Plant.—Beautiful woody climber; stem smooth, shining, hollow, purplish; leaves persistent, evergreen, lanceolate, entire; flowers Jan.–April, large, fragrant, poisonous, deep yellow, corolla funnel-shaped, 2.5–4 Cm. (1–1$\frac{3}{5}$′) long, stamens 5, dimorphous; fruit flat, brown capsule, 18 Mm. ($\frac{3}{4}$′) long, 2-celled, 4–6 winged-seed in each cell. Rhizome, cylindrical, usually in pieces 3–20 Cm. (1$\frac{1}{5}$–8′) long, 3–30 Mm. ($\frac{1}{8}$–1$\frac{1}{5}$′) thick, light yellowish-brown, longitudinally wrinkled with purplish-brown lines, transverse fissures; upper surface with few stem-scars, under and side portions with numerous roots and root-scars; fracture tough, splintery, internally pale yellow; bark thin, 1 Mm. ($\frac{1}{25}$′), wood distinctly radiate, excentral, pith disintegrated; odor slight; taste bitter; roots light brown; fracture one-half transverse, the other oblique or splintery. POWDER, yellowish-brown; microscopically—tracheæ, bast-fibres, fibre-tracheids, starch grains, .004–.008 Mm. ($\frac{1}{6250}$–$\frac{1}{3125}$′) broad, calcium oxalate prisms, few stone cells, sclerenchymatous fibres. *Solvents:* diluted alcohol; water partially. Dose, gr. 2–10 (.13–.6 Gm.).

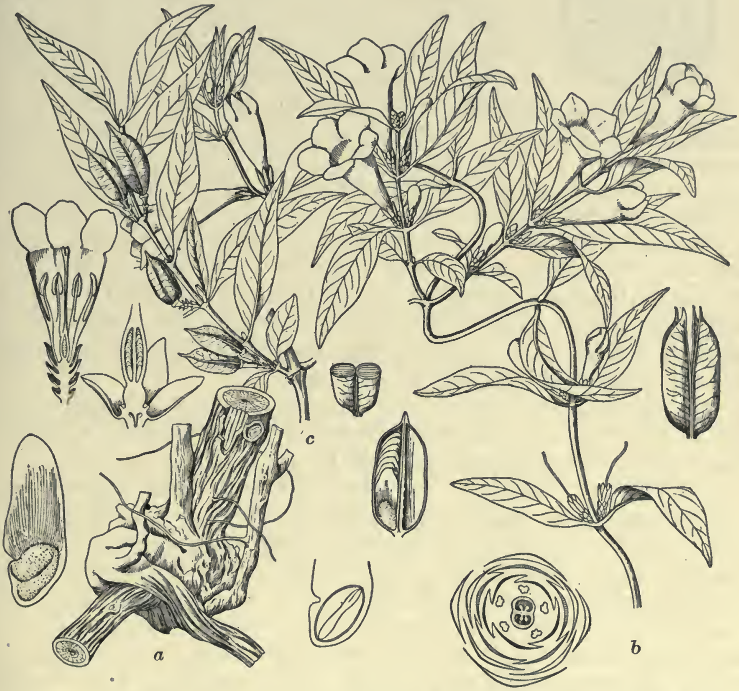


FIG. 307.—*Gelsemium sempervirens: a*, rhizome; *b*, flowering branch; *c*, fruiting branch ($\frac{1}{4}$ natural size); also flower, ovary, fruit, seed, floral diagram, enlarged.

ADULTERATIONS.—Aerial stem (hollow, small, dark purplish, thin corky layer, bast-fibres in thick bundles close to cambium, destitute of alkaloids and gelsemic acid); roots of the tree Jasmine, many starch grains in pith and medullary ray cells, indurated pith cells absent, bast-fibres around sieve tubes.

Commercial.—Plant ascends large trees forming festoons from one to another, and when in bloom delightfully perfumes surrounding atmosphere, for which it sometimes is cultivated; should not be confused with tree Jasmine (*Jas'minum* (*Plumeri'a*) *ru'bra*), called sometimes Gelsemium, which has abundance of starch grains in the pith and medullary ray cells, absence of indurated pith cells, and flowers with only 2 stamens. Rhizome should be collected just after flowering.

CONSTITUENTS.—Alkaloids .2–.5 p. c.: Gelsemine, Gelseminine, Gelsemic acid (Beta-methyl-æsculetin) .3–.4 p. c., volatile oil .5 p. c., 2 resins 4 p. c., starch, gum, pectin.

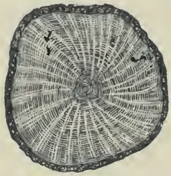


FIG. 308. — *Gelsemium sempervirens:* rhizome, transverse section.

Gelsemine, $C_{49}H_{63}N_5O_{14}$.—Obtained by adding acetic acid to concentrated tincture, precipitating with water; concentrate filtrate, remove gelsemic acid (?) with chloroform or ether, precipitate alkaloid with sodium carbonate, and extract it with chloroform, ether, or benzin. It is amorphous, white, very bitter, alkaline; with hydrochloric or nitric acid forms crystalline salts; with sulphuric acid + manganese dioxide—cherry-red, becoming olive-green. Dose, gr. $\frac{1}{60}$–$\frac{1}{20}$ (.001–.003 Gm.).

Gelseminine, $C_{12}H_{14}NO_2$. — Small, white, bitter crystals, soluble in alcohol, ether, chloroform, forms salts soluble in water (hydrochloride, nitrate, sulphate, etc.). Dose, gr. $\frac{1}{120}$–$\frac{1}{30}$ (.0005–.002 Gm.).

Gelsemic (Gelseminic) Acid, $C_{13}H_{11}O_5$.—A colorless, odorless, nearly tasteless crystalline body, once considered a glucoside, the same as æsculin, $C_{15}H_{16}O_9$; while this is not true, it is identical with beta-methyl-æsculetin, $C_9H_5(CH_3)O_4$, found in scopola, etc., soluble in hot alcohol, glacial acetic acid, alkalies with blue fluorescence—consequently is erroneously called gelsemic acid.

PREPARATIONS.—1. *Extractum Gelsemii.* Extract of Gelsemium. (Syn., Ext. Gelsem., Powdered Extract of Gelsemium; Fr. Extrait de Gelsemium; Ger. Gelsemiumextrakt.)

Manufacture: Macerate, percolate 100 Gm. with alcohol until exhausted, reclaim alcohol until residue is 50 Ml. (Cc.), evaporate at 70° C. (158° F.), frequently stirring, to soft extract, add 5 Gm. of a mixture (magnesium oxide 1, dried starch 3), mix thoroughly, spread thinly on glass or tinned-metal plates, or in porcelain dish, dry in air-bath at 70° C. (158° F.), pulverize, add of mixture (magnesium oxide and dried starch) q. s. 25 Gm.; mix thoroughly, pass through fine sieve; 1 Gm. represents 4 Gm. of the drug. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. $\frac{1}{6}$–3 (.01–.2 Gm.).

2. *Fluidextractum Gelsemii.* Fluidextract of Gelsemium. (Syn., Fldext. Gelsem., Fluid Extract of Gelsemium, Fr. Extrait fluide de Gelsemium; Ger. Gelsemiumfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: 80 p. c. alcohol. Dose, ♏ij–10 (.13–.6 Ml. (Cc.)).

3. *Tinctura Gelsemii.* Tincture of Gelsemium. (Syn., Tr. Gelsem.; Fr. Teinture de Gelsemium; Ger. Gelsemiumtinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: 65 p. c. alcohol. Dose, ♏x–60 (.6–4 Ml. (Cc.)).

PROPERTIES.—Nervine, sedative, mydriatic, antispasmodic, antiperiodic. Resembles very much in action hemlock, and somewhat digitalis, aconite, veratrum viride, antimony; heart action rendered slower and weaker, arterial tension lowered, motor cranial nerves paralyzed.

Uses.—Rheumatic neuralgia, intermittent, typhoid, and yellow fevers, lung affections, dysmenorrhœa, delirium tremens, chorea, hysteria, epilepsy, sunstroke, tetanus, rhus-poisoning, coryza, opium-poisoning, odontalgia, cardiac palpitation, mania.

Poisoning: Have pain about the eyes, dim vision, sometimes double, dilated pupils, rapid and feeble pulse, dizziness, projected eyeballs, loss of sensation and motion, dropping of upper eyelid (ptosis) and lower jaw, inability to enunciate, cold moist skin, anxious face, pain in chest, slow, labored breathing, convulsions resemble those of strychnine-poisoning, feeling of suffocation, foaming at the mouth, respiration ceases, finally heart ceases to beat from asphyxiation, death; conscious until near the end. Give evacuants (stomach pump, mustard, zinc sulphate), or wash out stomach with tannic acid solution, follow with hypodermic of morphine, atropine, stimulants, ammonia, coffee, alcohol, digitalis, strychnine, external heat and friction.

Incompatibles: Cardiac and diffusible stimulants, caustic alkalies, tannin.

Synergists: Motor depressants.

SPIGELIA. SPIGELIA.

Spigelia marylandica, *Linné.* — The dried rhizome and roots with not more than 10 p. c. of stems, foreign matter.

Habitat. United States, Maryland, southward, west to Texas, Wis.; in rich woods.

Syn. Pinkroot, Maryland (Carolina, Indian) Pink, Worm-grass (weed), Star-bloom, American Wormroot; Fr. Spigélie du Maryland; Ger. Spigelie, Marylandische Spigelie.

Spi-ge'li-a. L. *Spigelius,* after Adrian von der Spiegel (1558–1625), professor of anatomy and surgery at Padua, Flemish botanist, who first gave directions for preparing an herbarium.

Ma-ry-lan'di-ca. L. of, or belonging to Maryland—*i. e.,* its supposed habitat and one most northern.

Plant.—Perennial herb; stems several, .3–.6 M. (1–2°) high, erect, round below, square above, purplish, smooth; leaves sessile, ovate-lanceolate, 5–7.5 Cm. (2–3′) long, entire; flowers June–July, 4–12, large, sessile, on one side of stem above the leaves, spike; corolla funnel-shaped, 5 Cm. (2′) long, scarlet-red outside, yellow inside; fruit compressed, 2-seeded, yellow; seeds few, yellow. Rhizome, horizontal, slightly oblique, flexuous, branched, 1.5–5 Cm. ($\frac{3}{5}$–2′) long, 2–5 Mm. ($\frac{1}{12}$–$\frac{1}{5}$′) thick, dark brown, slightly annulate, with scars of bud-scales, knotty above from approximate stem-bases, bearing cup-shaped scars; from lower and lateral portions numerous long, rather coarse, sparingly branched, brittle roots; fracture short; internally differentiated into 3 nearly equal zones—pith, wood, bark; odor slightly aromatic; taste bitter, pungent. Few if any roots have thin, terminal portions with bark stripped from the slender strands of wood; stems attached often 6 Cm. ($2\frac{2}{5}'$) long, 3 Mm. ($\frac{1}{8}'$) thick, grayish-brown, nodes annulate, marked by opposite leaf-scars. POWDER, grayish-brown; microscopically—numerous starch grains, .002–.006 Mm. ($\frac{1}{12500}$–$\frac{1}{4150}'$) broad, fragments of lignified tracheæ and tracheids conspicuous, few fragments of tracheæ with spiral thickening, few bast-fibres and reddish-brown epidermal cells. *Solvents:* diluted alcohol; boiling water. Dose, ʒss–2 (2–8 Gm.); children, gr. 10–20 (.6–1.3 Gm.).

ADULTERATIONS.—Common: Rhizome of *Ruel'lia cilio'sa,* larger, paler, fewer coarse roots, with readily separating bark, cystoliths, contributing the so-called "East Tennessee Pinkroot," once attributed to *Phlox carolina,* and intentionally marketed, entire or admixed, in packages under the name of spigelia; also *Phlox ovata* and P. *glaberrima,* rhizomes and roots closely resemble spigelia, but darker and less ridged than ruellia; small amounts of saponaria, serpentaria, hydrastis, caulophyllum, dioscorea, collinsonia, earthy matter.

Commercial.—Pinkroot, now exterminated by ruthless collection from many sections, flourishes in rich soil near the border of woods, and rarely grows north of the Potomac River. The Creek and Cherokee Indians formerly collected much of it in Georgia by pulling up the entire plant and marketing it in bales, 300–350 pounds (136–158 Kg.); now only the official portion is collected, dried carefully, packed in casks or bales and sent into commerce via St. Louis, New Orleans, the most coming from S. W. States; that in casks is preferred, being less damp and moldy.

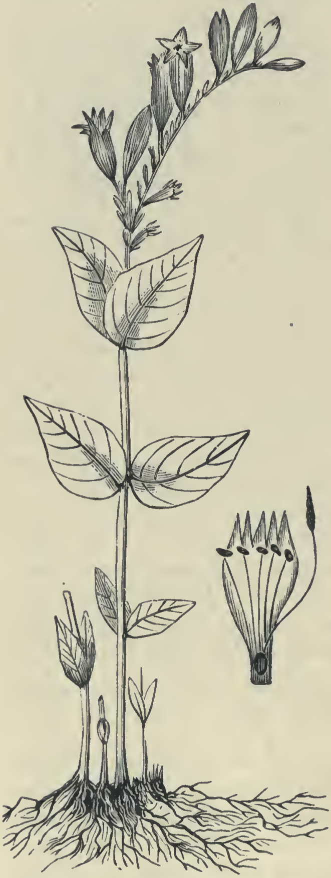


FIG. 309.—*Spigelia marylandica.*

CONSTITUENTS.—Bitter principle, Spigeline, volatile oil, resins, tannin, wax, fat, gum, ash 8–10 p. c.

Bitter Principle.—This is precipitated by tannin, but not by lead acetate, is soluble in water, alcohol, insoluble in ether.

Spigeline.—Volatile alkaloid obtained by distilling with milk of lime over a paraffin-bath, collecting distillate in hydrochloric acid, evaporating to dryness, crystallizing from alcoholic solution. *Tests:* 1. With iodine—brownish-red precipitate. 2. With Mayer's test (potassio-mercuric iodide)—white crystalline precipitate, soluble in alcohol, ether, acids, its solubility in this latter distinguishing it from all other alkaloids. 3. Benzin removes from *Phlox carolina* a hydrocarbon (crystalline, white, tasteless) 1 p. c., fat, wax, red coloring matter, thus differing somewhat from spigelia when treated similarly.

Preparations.—1. *Fluidextractum Spigeliæ.* Fluidextract of Spigelia. (Syn., Fldext. Spigel., Fluid Extract of Spigelia, Fluidextract of Pink Root; Fr. Extrait fluide de Spigélie; Ger. Spigelienfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: diluted alcohol. Dose, ʒss–2 (2–8 Ml. (Cc.)); child 3 years old, ♏x–20 (.6–1.3 Ml. (Cc.)).

Unoff. Prep.: Compound Infusion (Worm Tea), 15 Gm. + senna 10, fennel 10, manna 30, water q. s. 500 Ml. (Cc.), dose, ℥ij–5 (60–150 Ml. (Cc.)).

Properties.—Anthelmintic, toxic, mydriatic. Large doses cause narcotic poisoning, vertigo, dim vision, mydriasis, spasms, convulsions; but if it should purge, as it often does, only a few of these symptoms occur—hence no danger when combined with a direct cathartic.

Uses.—To destroy round worms (*Ascaris lumbricoides*); usually associated with a cathartic, as senna, calomel, etc., which hastens the removal of the benumbed worm from the system before it has time to recover from the effect of the spigelia.

Poisoning: Have dimness of vision, vertigo, dilated pupils, dry throat, convulsions, delirium. Give wine, ammonia, brandy, diffusible stimulants, amyl nitrite, atropine, digitalis.

Allied Plants:

1. *Spigelia anthel'mia, Demerara Pink Root, Worm Grass*—W. Indies. Used for a long time by the native Indians as a vermifuge and narcotic; fresh root has nauseous odor, is bitter, acrid, and kills cattle.

2. *Phlox' caroli'na, Carolina* or *Georgia Pink.*—This has a knotty and lighter colored rhizome with a central pith; it is also an anthelmintic, as is *P. glaber'rima.*

NUX VOMICA. NUX VOMICA.

Strychnos Nux-vomica, *Linné.*	The dried, ripe seeds, containing 2.5 p. c. of alkaloids.

Habitat. India, Hindustan, E. India islands, Malabar, Ceylon, Java, N. Australia.

Syn. Nux. Vom., Dog (Quaker, Bachelor's) Buttons, Vomit (Poison) Nut, Dog Poison, Crow-fig, Ratsbane, False Angustura, Columbrina, Ordeal-root, Nux Metella, Semen Nuces Vomicæ; Fr. Noix vomique; Ger. Semen Strychni, Brechnuss, Krähenaugen.

Strych'nos. L. fr. Gr. στρύχνος, night shade, equivalent to L. *solanum,* used anciently for several poisonous plants, but not for the present one.

Nux' Vom'i-ca. L. *nux,* a nut, + *vomere,* to vomit—*i. e.,* excessive doses may vomit, or require vomiting to save life, small doses may allay it.

Plant.—Small tree, 4.5–9 M. (15–30°) high, trunk short, thick, crooked, branches irregular, bark yellowish-gray, nearly smooth;

leaves exstipulate, 5–10 Cm. (2–4′) long, roundish, oval, 3–5-nerved, apex acute, entire, shining; flowers in winter, whitish, funnel-shaped, 8 Mm. ($\frac{1}{3}$′) long, paniculate cymes; fruit shining, globular, 4–5 Cm. (1$\frac{3}{5}$–2′) thick, rind thin tough, orange-yellow when ripe, filled with poisonous white gelatinous pulp in which 1–5 seeds are immersed irregularly. SEEDS, orbicular, nearly flat, occasionally irregularly bent, 10–30 Mm. ($\frac{2}{5}$–1$\frac{1}{5}$′) broad, 4–5 Mm. ($\frac{1}{6}$–$\frac{1}{5}$′) thick, very hard when dry; grayish, greenish-gray, covered with appressed hairs giving a silky lustre; hilum—a circular scar at the centre of one of the flattened sides and connected with micropyle at the edge by a ridge; internally showing a thin, hairy seed-coat and large grayish-white endosperm, at one end of which is embedded a small embryo with 2 ovate 5–7-nerved cotyledons; inodorous; taste intensely, persistently bitter. POWDER, light gray; microscopically—chiefly thick-walled endosperm cells containing fixed oil globules, few aleurone grains, lignified non-glandular hairs with walls having large pores, few spherical starch grains in tissues of adhering pulp. *Solvents:* alcohol (75 p. c.); boiling water partially. Dose, gr. $\frac{1}{2}$–5 (.03–.3 Gm.).

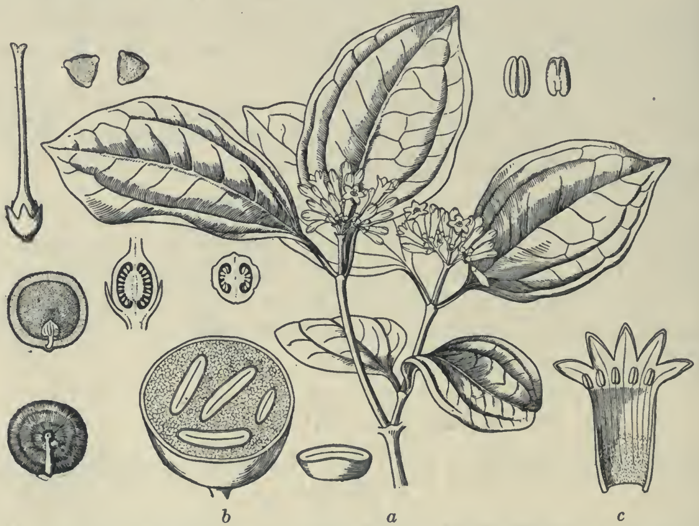


FIG. 310.—*Strychnos Nux-vomica: a*, flowering branch ($\frac{1}{4}$ natural size); *b*, cross-section of fruit; *c*, corolla; also anther, pollen, pistil, ovary, seed, enlarged.

ADULTERATIONS.—SEEDS: Rare—as nothing resembles them closely; POWDER: Common—various inert substances (increasing amount of hairs) and olive stones, often 50 p. c. RASPED: "Vegetable ivory" (coroso, negrito), seeds of *Phytel'ephas macrocar'pa* (Australia, used natively for making buttons) and of *Metrox'ylon vitie'se* (so-called Australian "coroso," Fiji Islands, imported into Hamburg for the purpose; odorless, tasteless, bony, revealing decided structural differences under the microscope).

Commercial.—Plant resembles our dogwood and its fruit a small orange. Seeds are washed free of pulp and dried in the sun, the best being recognized by light color, ample breadth, thin edge, excessive silkiness, and prominent hilum; they may readily be powdered by breaking into small pieces and drying several days with hot air or carefully applied direct heat; powder should be uniform so as not to retard or prevent thorough exhaustion by menstruum. There are four varieties valued in the order named: 1, *Bombay;* 2, *Cochin* (*Calcutta*); 3, *Ceylon;* 4, *Madras.*

CONSTITUENTS.—Alkaloids 2.5–4–5.3 p. c.: Strychnine .25–2 p. c., Brucine .5–2 p. c., Igasurine (probably impure brucine), all combined with igasuric (strychnic, tannic, caffeo-tannic) acid; Loganin, fixed oil, proteids 11 p. c., yellow coloring matter, gum, sugar 6 p. c., ash 1–3.5 p. c. Dunstan and Short found total alkaloids to vary from 2.74 p. c. in small Madras to 3.9 p. c. in large, silky Bombay seeds, of which 30–50 p. c. was strychnine.

Strychnina, Strychnine, $C_{21}H_{22}N_2O_2$, *official.*—(Syn., Strych., Strychnia; Fr. Strychnine; Ger. Strychninum, Strychnin.) This alkaloid is found not only in nux vomica, but also in other loganiaceous plants (seeds); it was discovered by Pelletier, 1818, and may be obtained by boiling powdered seeds with acidulated (HCl or H_2SO_4) water, thus liberating tannic (igasuric) acid, mucilage, coloring matter, etc., and forming chlorides or sulphates of the alkaloids; concentrate and add milk of lime to decompose alkaloidal salts (forming $CaCl_2$ or $CaSO_4$) and to precipitate strychnine and brucine; wash precipitate, treat it with diluted alcohol to dissolve brucine, or with alcohol or benzene to take out strychnine, thus leaving brucine in the mother-liquor. If diluted alcohol be used for brucine, then by boiling residue with alcohol strychnine is obtained; can purify with animal charcoal and reprecipitate with ammonia. It is in colorless, transparent, prismatic crystals, white crystalline powder, odorless (must use great caution in tasting, and then only in very dilute solutions, which are exceedingly bitter—1 in 700,000), permanent, soluble in water (6420), boiling water (3100), alcohol (136), boiling alcohol (34), chloroform (5), benzene (180), very slightly in ether; saturated solutions alkaline, lævorotatory; forms numerous salts (hydrochloride, nitrate, phosphate, sulphate, etc.). *Tests:* 1. With sulphuric acid containing 1 p. c. of ammonium vanadate—deep violet-blue, changing to deep purple, cherry-red; incinerate 1 Gm.—ash .1 p. c. 2. Solution of .1 Gm. in sulphuric acid 2 Ml. (Cc.)—only pale yellow (abs. of readily carbonizable organic substances) until a fragment of potassium dichromate is added—deep blue color, changing to deep violet, purplish-red, cherry-red, orange, yellow. *Impurities:* Brucine, readily carbonizable organic substances; commercial strychnine contains some homo-strychnine, $C_{22}H_{24}N_2O_2$. Should be kept in well-closed containers. Dose, gr. $\frac{1}{60}$–$\frac{1}{20}$ (.001–.003 Gm.).

Strychninæ Nitras, Strychnine Nitrate, $C_{21}H_{22}N_2O_2.HNO_3$, *official.*—(Syn., Strych. Nit.; Fr. Azotate (Nitrate) de Strychnine; Ger.

Strychninum nitricum, Strychninnitrat, Salpetersaures Strychnin.) Obtained by dissolving strychnine (1) in diluted nitric acid (1886), or strychnine (5), hot dist. water (50), dilute nitric acid q. s., when neutral evaporate, crystallize. It is in colorless, glistening needles, white, crystalline powder, odorless (must use great caution in tasting, and then only in very dilute solutions, which are exceedingly bitter—1 in 700,000), permanent, soluble in water (42), boiling water (9), alcohol (150), hot alcohol (77), glycerin (50), chloroform (105), insoluble in ether; saturated aqueous solution neutral, slightly acid, lævorotatory; contains 84.13 p. c. of the alkaloid. *Tests:* 1. Pour carefully a solution of the salt into a test-tube upon a layer of sulphuric acid containing diphenylamine in solution—blue color at zone of contact. 2. Heat with hydrochloric acid—bright red color. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{60}$–$\frac{1}{20}$ (.001–.003 Gm.).

Strychninæ Sulphas, Strychnine Sulphate, $(C_{21}H_{22}N_2O_2)_2.H_2SO_4+5H_2O$, *official.*—(Syn., Strych. Sulph.; Fr. Sulfate de Strychnine; Ger. Strychninum sulfuricum, Strychninsulfat, Schwefelsaures Strychnin.) Obtained by dissolving strychnine in diluted sulphuric acid, avoiding excess, evaporating filtrate, crystallizing. It is in colorless, white, prismatic crystals, white, crystalline powder, odorless, efflorescent (must use great caution in tasting, and then only in very dilute solutions, which are exceedingly bitter—1 in 700,000), soluble in water (32), boiling water (7), alcohol (81), hot alcohol (26), chloroform (220), glycerin, insoluble in ether; saturated aqueous solution (1 in 50) neutral, slightly acid; contains 78.03 p. c. of the alkaloid. *Tests:* 1. Aqueous solution with barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. 2. Dried to constant weight at 100° C. (212° F.)—loses 11 p. c. (all water of crystallization). Should be kept in well-closed containers. Dose, gr. $\frac{1}{60}$–$\frac{1}{20}$ (.001–.003 Gm.).

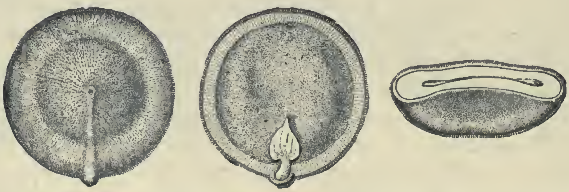


Fig. 311.—Nux vomica: whole seed, cut longitudinally, and cut transversely.

Brucine (Brucina), $C_{23}H_{25}N_2O_4$.—Named after James Bruce (1730–1794), a Scotch traveler, and obtained in extracting strychnine; occurs in rectangular, octahedral crystals, containing $4H_2O$, soluble in water (850), readily in chloroform, alcohol, ammonia, creosote; forms numerous salts, less bitter than strychnine, 12 times weaker, 3 times slower physiologically; by some considered to be strychnine + resin, as it has same action. *Tést:* 1. With nitric acid—blood-red color, changing to orange-yellow; now add stannous chloride, sulphurous acid, or any deoxidizing agent—violet-red (this completely bleaches morphine-red). Dose, gr. $\frac{1}{12}$–$\frac{1}{2}$ (.005–.03 Gm.).

Igasurine (Igasuria), fr. Malay, *igasura*, the nux vomica.—Obtained from mother-waters of strychnine and brucine after their precipitation with lime; occurs in white crystals; by some claimed to be a mixture of 9 alkaloids, mostly brucine; others doubt its existence.

Igasuric Acid.—Identical with tannic or caffeo-tannic acid, amorphous, dark green with ferric salts, by hydrolysis yields glucose and caffeic acid.

Loganin, $C_{25}H_{34}O_{14}$.—Bitter glucoside, in white prisms, soluble in water, alcohol; with sulphuric acid—red, then purple, and splits into sugar and loganetin.

PREPARATIONS.—1. *Extractum Nucis Vomicæ.* Extract of Nux Vomica. (Syn., Ext. Nuc. Vom., Powdered Extract of Nux Vomica; Fr. Extrait de Noix vomique; Ger. Extractum Strychni, Brechnussextrakt.)

Manufacture: Macerate, percolate 100 Gm. with 75 p. c. alcohol until exhausted, reclaim alcohol, evaporate residue to 20 Ml. (Cc.), transfer to separator (flask), rinse still with little warm 75 p. c. alcohol, which add to separator, + water 15 Ml. (Cc.) + purified petroleum benzin 20 Ml. (Cc.), shake thoroughly several minutes, decant benzin layer, shake residue again with purified petroleum benzin 10 Ml. (Cc.), decant benzin layer; wash mixed benzin solutions with water 10 Ml. (Cc.) + diluted sulphuric acid 1 Ml. (Cc.), separate aqueous layer, wash twice again with same menstruum; collect aqueous solutions in a separator, render alkaline with ammonia water, shake out with 3 portions of chloroform (2, 1, 1 Ml. (Cc.) respectively), add chloroform solutions to the extract, evaporate on water-bath to dryness, frequently stirring; after assay add enough mixture (magnesium oxide 1 + dried starch 3) for extract to contain 16 p. c. of total alkaloids; pulverize, mix thoroughly, pass through fine sieve; contains 15.2–16.8—16 p. c. of the alkaloids. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.).

2. *Fluidextractum Nucis Vomicæ.* Fluidextract of Nux Vomica. (Syn., Fldext. Nuc. Vom., Fluid Extract of Nux Vomica; Fr. Extrait fluide de Noix-vomique; Ger. Krähenaugen (Strychnossamen) fluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: 75 p. c. alcohol; reserve first 80 Ml. (Cc.), in which dissolve soft extract, assay, and add enough menstruum for the 100 Ml. (Cc.) to contain 2.37–2.63—2.5 Gm. of alkaloids. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

3. *Tinctura Nucis Vomicæ.* Tincture of Nux Vomica. (Syn., Tr. Nuc. Vom.; Fr. Teinture de Noix-vomique; Ger. Tinctura Strychni, Brechnusstinktur, Krähenaugentinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: 75 p. c. alcohol—percolate 95 Ml. (Cc.), assay, and add enough menstruum for the 100 Ml. (Cc.) to contain .237–.263—.25 Gm. of total alkaloids; rate of flow of percolate should be 10 drops per minute. Dose, ♏v–20 (.3–1.3 Ml. (Cc.)).

Unoff. Preps.: Elixir Strychnine Valerate—strychnine valerate, .0175 Gm. dist. water .5, tinct. of vanilla 1.5, comp. tinct. of cudbear 1.5, aromatic elixir q. s. 100, dose, ʒj–2 (4–8 Ml. (Cc.)). *Solution of Strychnine Acetate,* strychnine .178 Gm., dil. acetic acid 3.5, alcohol 25, comp. tinct. of cardamom 1, dist. water q. s. 100, dose, ♏v–15 (.3–1 Ml. (Cc.)). *Abstract,* dose, gr. $\frac{1}{4}$–2 (.016–.13 Gm.). *Decoction* of leaves used externally in rheumatism. *Strychninæ Glycerophosphas. Strychninæ Valeras. Strychninæ Hydrochloridum* (Br.). *Liquor Strychninæ Hydrochloridi* (Br.), 1 p. c., dose, ♏ij–8 (.13–.5 Ml. (Cc.)).

PROPERTIES.—Motor excitant, spinant, tonic, stomachic, respiratory, cardiac, muscular, and nervous stimulant, antiseptic, poisonous. Strychnine and nux vomica are identical, increasing the vascularity of gastric mucous membrane, secretion of gastric juice, and peristalsis by stimulating the intestinal muscular coat (purgative), stimulates direct the cardiac muscles or the motor ganglia and nerves of special sense; strychnine, full dose, gr. $\frac{1}{10}$ (.006 Gm.), gives dilated pupils, jerky limbs, spasmodic respirations, stiff lower jaw, cerebral tension, shuddering, depression, facial smile or grin. Thebaine (opium) acts similarly. The spasms of tetanus are constant, of strychnine intermittent, with meaningless smile; the modified lockjaw, absence of wound, and rapidly developed symptoms differentiate the two. Strychnine is absorbed rapidly, but eliminated slowly by urinary, salivary, and cutaneous channels.

USES.—Strychnine was used first in paralysis, and now in atonic dyspepsia, gastric catarrh, bowel atony, pregnancy and phthisis vomiting, nervous cough, bronchitis, anæmia, paralytic condition, lead palsy, inebriate and diphtherial paralysis, amaurosis from lead, tobacco, alcohol, paralysis of bladder, incontinence of urine, sexual impotence, tetanus, chorea, epilepsy, delirium tremens, spermatorrhœa, neuralgia, dysmenorrhœa, diarrhœa, dysentery, cholera, antidote to hydrated chloral, morphine, physostigmine. A tolerance for it is established quickly, but gr. $\frac{1}{12}$ (.005 Gm.) has killed, while gr. $\frac{1}{2}$–2 (.03–.13 Gm.) as a rule is considered fatal; extract, gr. 3 (.2 Gm.) also have killed.

Poisoning: Strychnine, gr. $\frac{1}{2}$ (.03 Gm.) or more, produces within half an hour difficult breathing, sense of suffocation and impending death, muscular rigidity, stiffness of neck, tonic or persistent convulsions of all extensor muscles, coming on at intervals 3–30 minutes, lasting a few seconds to one or more minutes, these quickly recurring at every noise, touch or peripheral irritation, between convulsions complete relaxation, face dusky and with ghastly grin, angles of mouth drawn back and upward, body curved so as to rest on head and heels, eyeballs prominent, pupils dilated during paroxysm, eyes fixed and open, lips livid, great thirst but unable to drink owing to spasms of jaws, respiration suspended during convulsions, pulse feeble and rapid, involuntary defecation and urination, lockjaw, death in 2–3 hours from asphyxia; mind clear until near the end, when carbon dioxide narcosis (cyanosis), exhaustion and nervous storm set in. Place in horizontal position, in dark room remote from all noise, use evacuants, (stomach-pump, emetics, purgatives), follow with antidotes; tannin dissolved in water, charcoal, potassium permanganate; if ingested relax (convulsions) with chloroform or ether, and give by rectum potassium bromide gr. 60 (4 Gm.) and hydrated chloral gr. 40 (2.6 Gm.) in starch water; amyl nitrite, (soluble iodides, tobacco, opium, physostigmine, atropine, conium, cannabis). Empty bladder often (catheter), practise artificial respiration.

Incompatibles: Hydrated chloral, potassium bromide, tobacco, chloroform, ether, tannin, bromides, iodides, chlorides.

Synergists: Motor excitants, ergot, ustilago, electricity, cold.

Allied Product:

1. The *bark* was once (1806–1837) upon the market in England and Holland, being mixed usually with Angustura, and since then has been known as *False Angustura Bark;* it is poisonous, gray, cork patches rust-color, warty, inside brown, fracture smooth, no white striæ (calcium oxalate); contains strychnine, brucine, etc. The wood is used in domestic medicine; all portions are medicinal.

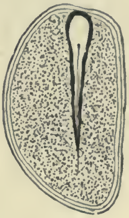


Fig. 312.—Ignatia: vertical section.

Allied Plants:

1. *Strychnos Igna'tii, Ignatia, St. Ignatius' Bean.*—The seed, official 1860–1890; Philippine Islands. Large climbing shrub, leaves ovate, acute at apex, smooth, flowers white, tubular, racemes; fruit resembles a pear, pericarp brittle; seeds 24, imbedded in bitter pulp, 25 Mm. (1′) long, 15 Mm. ($\frac{3}{5}$′) broad, ovate, triangular, grayish, blackish, nearly smooth, few or no hairs, horny, very bitter; contains more strychnine, but less total alkaloids than nux vomica—strychnine .5–1.5 p. c., brucine .5–1.4 p. c., proteids 10 p. c., ash 4 p. c.; used like nux vomica. Dose, gr. $\frac{1}{2}$–3 (.03–.2 Gm.); extract, 6 p. c. alkaloids (75 p. c. alcohol); tincture, 10 p. c. (85 p. c. alcohol), dose, ♏v–20 (.3–1.3 Ml. (Cc.)).

2. *S. Tieu'te.*—Java; seeds resemble nux vomica but smaller, whiter; contain strychnine, brucine; extract used natively for arrow poison. *S. potato'rum,* India; seeds subglobular, 12 Mm. ($\frac{1}{2}$′) wide, brownish-gray, not bitter, no strychnine; used natively for clearing muddy water. *S. Colubri'na,* India; yields true *Lignum Colubrinum,* for which nux vomica branches often are substituted. All parts bitter and contain strychnine and brucine; once used as antidote to snake-bites, hence the name.

3. *S. toxif'era* (*Castelnœa'na*), *Curara, Curare, Woorara, Urari.*—Brazil, Guiana. Extract of bark (South American arrow poison), blackish, hygroscopic, bitter, friable, 75 p. c. soluble in water; contains curarine, $C_{18}H_{35}N$ (yellowish-brown, bitter alkaloid), resin, fat. Diaphoretic, sedative, irritant; best drug in tetanus. Dose, gr. $\frac{1}{10}$–$\frac{1}{3}$ (.006–.02 Gm.); curarine gr. $\frac{1}{100}$ (.0006 Gm.)—resembles digitalis in action.

58. GENTIANACEÆ. Gentian Family.

Jen-shia-na′se-e. L. *Gentian-a* + aceæ, fr. Gr. γεντιανή—*i. e.*, after Gentius, King of Illyria, who first discovered and experienced its virtues. Herbs, shrubs. Distinguished by being smooth, with bitter principles; leaves exstipulate, entire, glabrous, sessile; flowers regular, 5's, sometimes 4, 6, 8, 10; ovary 1-celled; fruit capsule, 1–2-celled, 2-valved; seeds many; universal; tonic, febrifuge, stomachic.

Genus: **1. Gentiana.**

GENTIANA. GENTIAN.

Gentiana lutea, *Linné.* } The dried rhizome and roots.

Habitat. C. and S. Europe (France, Austria, Germany, Switzerland, Portugal, England); mountainous districts.

Syn. Yellow Gentian Root, Pale Gentian, Bitter Root, Bitterwort, Felwort, Radix Gentianæ Rubræ, Luteæ or Majoris; Br. Gentianæ Radix; Fr. Gentiane, Racine de Gentiane (de Gentiane jaune); Ger. Radix Gentianæ, Enzianwurzel, Bitterwurzel, Rother (Gelber) Enzian.

Gen-ti-a′na. L. see etymology, above, of Gentianaceæ.

Lu′te-a. L. *luteus*, golden-yellow—*i. e.*, the flowers.

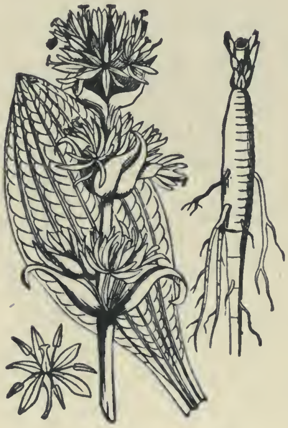


Fig. 313.—*Gentiana lutea.*

Plant.—Large perennial herb; stem thick, hollow above, .6–1.3 M. (2–4°) high, yellowish-green, underground portion .6–1 M. (2–3°) long, branched; leaves entire, 5–7-nerved, 15–30 Cm. (6–12′) long, ovate, glabrous, yellowish-green; flowers June–Aug., numerous, cymes of 20 or more; corolla 5 Cm. (2′) long, orange-yellow, spotted, 6 segments; fruit 1-celled, ovate capsule, 3 Cm. ($1\frac{1}{5}$′) long, many winged-seeds. Rhizome (root), in subcylindrical, sometimes branching pieces, of variable length, 5–35 Mm. ($\frac{1}{5}$–$1\frac{2}{5}$′) thick, yellowish-brown, rhizome annulate, roots longitudinally wrinkled; fracture short and uneven when dry, tough and flexible when damp; internally yellowish-brown, bark .5–2 Mm. ($\frac{1}{50}$–$\frac{1}{12}$′) thick, separated from somewhat spongy woody portion by dark brown cambium zone; odor strong, characteristic; taste slightly sweetish, strongly and persistently bitter. Powder, yellowish-brown; microscopically—parenchymatous cells with fragments of scalariform or reticulate tracheæ, few or no starch grains; no stone cells or sclerenchymatous fibres. *Solvents:* water; diluted alcohol. Dose, gr. 5–30 (.3–2 Gm.).

Adulterations.—Rhizome: Through carelessness—rhizomes, roots of allied species; aconite, belladonna, white hellebore, orris (none yellow internally), *Rumex alpi'nus* (odor and taste distinct—bitter, astringent without gentian aroma); Powder: Ground pine-wood, almond shells, olive stones, sack and rope fibre, etc.

Commercial.—Plant, remarkable for beauty and size, was used by the Greeks and Arabians, and grows in the Alps, Apennines, Pyrenees, Jura, Vosges, 900–1200 M. (3000–4000°) elevation, along with veratrum album, the leaves of both closely resembling. Rhizome and roots are collected usually when in flower, washed, dried, and exported from Germany, France (Marseilles)—our chief supply. Austria imposes a fine for collecting any less than 2 Cm. ($\frac{4}{5}'$) thick at the crown—product of plants 3 years old, which insures propagation through having produced seeds.

Constituents.—Gentiopicrin, Gentiin, gentiogenin, $C_{10}H_{10}O_4$, gentienin, $C_{14}H_{10}O_5$, gentianose, $C_{16}H_{66}O_{31}$ (uncrystallizable sugar), 14 p. c., resin, gum, pectin, fixed oil 6 p. c., yellow coloring matter, identical with quercitrin, ash 6 p. c.

Gentiopicrin, $C_{16}H_{20}O_9$.—Bitter glucoside, upon which activity depends, obtained by diluting alcoholic extract with alcohol, extracting with equal weight of warm hydrous ether, evaporating to get crystals that contain 1 p. c. gentiin, which can be removed by recrystallizing from acetic ether + 2 p. c. of water; by hydrolysis yields glucose and gentiogenin (white crystals).

Gentiin, $C_{25}H_{28}O_{14}$.—Crystallizes from 60 p. c. hot alcohol in yellow needles, insoluble in water, blackish-green with ferric chloride, heated with 4 p. c. of sulphuric acid splits into glucose, xylose and gentienin.

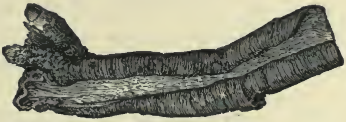


Fig. 314.—Gentian rhizome, longitudinally sliced, about one-half natural size.

Preparations.—1. *Extractum Gentianæ.* Extract of Gentian. (Syn., Ext. Gentian.; Fr. Extrait de Gentiane; Ger. Enzianextrakt.)

Manufacture: Macerate, percolate 100 Gm. with water until exhausted, boil down to 200 Ml. (Cc.), strain, evaporate to pilular consistence; yield 30 p. c. Dose, gr. 2–10 (.13–.6 Gm.).

2. *Fluidextractum Gentianæ.* Fluidextract of Gentian. (Syn., Fldext. Gentian, Fluid Extract of Gentian; Fr. Extrait fluide de Gentiane; Ger. Enzianfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: diluted alcohol. Dose, ♏v–30 (.3–2 Ml. (Cc.)).

3. *Tinctura Gentianæ Composita.* Compound Tincture of Gentian. (Syn., Tr. Gentian Co.; Fr. Teinture de Gentiane composée; Ger. Zusammengesetzte Enziantinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 101—using gentian 10 Gm., bitter orange peel 4 Gm., cardamom seed

1 Gm., packing moderately; 1st menstruum: glycerin 10 Ml. (Cc.), alcohol 50 Ml. (Cc.), water 40 Ml. (Cc.), finishing with diluted alcohol q. s. 100 Ml. (Cc.). Dose, ʒj–2 (4–8 Ml. (Cc.)).

Unoff. Preps.: Elixir, 3.5 p. c. (fldext.), comp. spirit of cardamom, 1.5, sodium citrate 3, +, dose, ʒj–2 (4–8 Ml. (Cc.)). *Elixir Gentianæ et Ferri*—tinct. of ferric citro-chloride 10 p. c., elixir of gentian q. s. 100. *Elixir Gentianæ et Ferri Phosphatis*—ferric phosphate 1.75 p. c., dist. water 3.5, elixir of gentian q. s. 100. *Elixir Gentianæ Glycerinatum*—fldext. of gentian 1 p. c., fldext. of taraxacum 1.5, acetic ether .05, phosphoric acid .5. *Infusum Gentianæ Compositum* 3 p. c., + bitter orange peel .8, coriander .8, dil. alc. q. s. 25, water q. s. 100, dose, ℥ss–1 (15–30 Ml. (Cc.)). *Tincture,* 20 p. c. *Alcoholic Beverage* (owing to fermentable sugar).

PROPERTIES.—Tonic, bitter, increases appetite, digestion (action local); large doses oppress stomach, irritate bowels, nauseate, and cause vomiting.

USES.—Dyspepsia, atonic gout, amenorrhœa, hysteria, scrofula, intermittents.

Allied Plants:

1. *Gentiana Elliot'tii (Catesbæ'i), Elliott's Gentian.*—The root, official 1820–1880; United States, grassy swamps. Perennial herb (20–60 Cm. (8–24′) high, rough; leaves 2.5–5 Cm. (1–2′) long, lanceolate, serrate; flowers Oct., blue, 4 Cm. (1$\frac{3}{5}$′) long; corolla 10 segments, 5 inner fringed; root resembles the official; constituents and uses similar; in infusion, wine, tincture. *G. purpu'rea* (purplish flowers), *G. pannon'ica* (dark purple flowers), and *G. puncta'ta* (yellow, purple-dotted flowers); all grow along with official, and collected for it.

2. *Sabba'tia angula'ris, American Centaury.*—The herb, official 1820–1880; United States. Plant .3–.6 M. (1–2°) high, stem branched above, square, smooth; leaves ovate, 2.5 Cm. (1′) long, heart-shaped; flowers deep rose, central star greenish, wheel-shaped, 5-parted, bitter; contains bitter principle, fat, erythrocentaurin. Used as tonic, febrifuge, diaphoretic, rheumatism, sore throat, fevers. Dose, gr. 15–60 (1–4 Gm.). *S. Elliot'tii, Quinine Flower; S. campes'tris,* and *Erythræ'a Centau'rium, European Centaury;* all may be used similarly.

3. *Swer'tia Chiray'ita, Chirata.*—The dried plant, official 1860–1910; N. India, mountains. Annual plant, 1 M. (3°) high, yellowish or purplish-brown; stem cylindrical below, quadrangular above, branched; wood yellowish, thin, enclosing large separable pith; root simple; leaves opposite, sessile, ovate-lanceolate, entire, 6 Cm. (2.5′) long; flowers small, panicles; fruit capsule, ovoid, acute, 1-celled, many-seeded; odor slight; taste intensely bitter; solvents: diluted alcohol, water partially; contains ophelic acid, chiratin, ash 4–8 p. c. (K, Ca, Mg, carbonates and phosphates). Tonic, febrifuge, stomachic, laxative, hepatic stimulant; large doses nauseate; indigestion, constipation. Dose, gr. 15–30 (1–2 Gm.; fluidextract (diluted alcohol), ♏xv–30 (1–2 Ml. (Cc.)); tincture, 10 p. c. (alcohol 67 p. c.), ʒss–1 (2–4 Ml. (Cc.)). *S. angustifo'lia,* and *S. pulchel'la,* both have entire

stems square, pith thin or wanting; less bitter but used to adulterate the preceding.

4. *Frase'ra carolinen'sis* (*Walte'ri*), *American Colombo.*—The root, official 1820–1880; United States. Perennial herb, 1–2.5 M. (3–8°) high, dark purple stem 2.5–5 Cm. (1–2′) thick; leaves in whorls 4–6, entire, spatulate; flowers July, yellow, purple-dotted, large; root fusiform, fleshy, yellow. Usually in segments 2.5 Cm. (1′) thick, annulate, orange-brown; odor gentian-like; taste sweet, bitter; constituents and uses like gentian. Dose, gr. 15–30 (1–2 Gm.).

5. *Menyan'thes trifolia'ta, Buckbean, Bogbean, Water Shamrock.*—The root (rhizome), official 1820–1840; dried leaves; United States. Perennial herb, 2.5–3.7 M. (8–12°) high; rhizome 1–2.5 Cm. (⅖–1′) thick, slightly longer, branching, black; leaves on petioles, 10–15 Cm. (4–6′) long, ternate, leaflets sessile, 5–8 Cm. (2–3′) long, obtuse, obovate, entire or crenate, smooth, pale green, inodorous, bitter; contains menyanthin (glucoside, yields menyanthol), mucilage, albumin, saccharose, fat, ash 10 p. c. Used as tonic, febrifuge, emmenagogue, antiscorbutic, vermifuge; large doses emetic, purgative; rheumatism, scrofula, scurvy, dropsy, intermittents, jaundice, dyspepsia, worms. Dose, gr. 15–30 (1–2 Gm.).

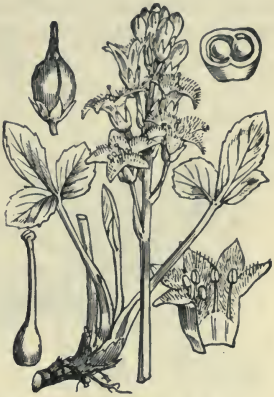


FIG. 315.—*Menyanthes trifoliata.*

59. APOCYNACEÆ. Dogbane Family.

A-pos-i-na'se-e. L. *Apocyn-um* + aceæ, fr. Gr. ἀπό, from, away, + κύων, a dog—*i. e.*, drives away or kills dogs, hence dogbane. Trees, shrubs. Distinguished by being milky, acrid, poisonous; leaves exstipulate, entire; calyx and corolla 5-lobed; from Asclepiadaceæ by stamens being free from style and stigma (insertion on the corolla), and granular pollen, filaments distinct; ovary 2, usually separate; fruit 2 follicles or drupes; tropics; purgative, tonic, febrifuge, poisonous.

Genera: **1. Strophanthus. 2. Aspidosperma.**

STROPHANTHUS. STROPHANTHUS.

Strophanthus {**Kombé,** *Oliver,* / **hispidus,** *De Candolle.*} {The dried, ripe seeds, deprived of the long awn.

Habitat. Tropical Africa (Kombé, Guinea, Senegambia), Asia, Philippines.

Syn. Strophanth.; Br. Strophanthi Semina; Fr. Strophanthus, Semence de Strophanthe; Ger. Semen Strophanthi, Strophanthussamen.

Stro-phan'thus. L. fr. Gr. στροφή, turning, to turn, twist, + ἄνθος a flower—*i. e.*, from the twisted and tailed lobes of the corolla.

Kom-be'. Native place of plant, in Gaboon district, Africa.

His'pi-dus. L. hairy, bristly—*i e.*, seeds covered with long, coarse hairs.

Plants.—Woody climbers, stem, several inches thick, emits milky juice; leaves rough; flowers Oct.–Nov., cream-color, yellow at base, purple-spotted above, cymes; corolla gamopetalous, lobes extended in narrow, tail-like ends, 22.5–30 Cm. (9–12′) long; fruit June, pair of follicles, 20–37.5 Cm. (8–15′) long, 2.5 Cm. (1′) thick, acuminate, each containing about 200 long-awned seeds. Seeds, lance-ovoid, flattened, obtusely edged, 7–20 Mm. ($\frac{1}{3}$–$\frac{4}{5}$′) long, 4 Mm. ($\frac{1}{6}$′) broad, 2 Mm. ($\frac{1}{12}$′) thick; light fawn, greenish tinge, silky-lustrous from dense coating of closely appressed hairs (*S. Kombe′*), or light dark-brown, nearly smooth, sparingly hairy (*S. hispidus*); ridge on one side from centre to summit; fracture short, soft, whitish, oily; odor heavy when crushed and moistened; taste very bitter. Powder, grayish-brown, odor distinct; microscopically—chiefly parenchyma cells and fragments of hairs (few in *S. hispidus*); mounted in hydrated chloral T. S. shows numerous oil globules; many fragments of endosperm greenish with sulphuric acid (strophanthin). Should be kept in tightly-closed containers, adding occasionally a few drops of chloroform or carbon tetrachloride, to prevent insect attack. *Solvents:* alcohol (65 p. c.); boiling water partially. Dose, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.).

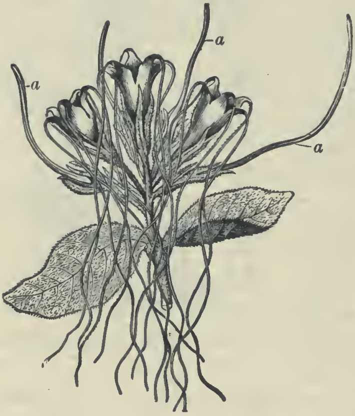


Fig. 316.—*Strophanthus Kombé:* flowering branch; *a, a, a,* budding branches.

Adulterations.—White, woolly strophanthus, *S. Nicholson′ii* (*as′per*), hairs white, long, producing shaggy, stout appearance; *S. gra′tus*, seeds brown, without hairs; *S. Courmon′tii*, seeds small, brownish, ventral ridge obscure, with calcium oxalate crystals; *Kickx′ia africa′na*, seeds with both ends acuminate, terete, hairless.

Commercial.—Plants abound in the forests between the coasts and centre of the continent, reaching the highest trees, and hanging in festoons and coils upon the ground. Fruit is collected by the natives who peel off husks (epicarp, mesocarp), preserve, and dry the smooth, yellowish-brown, more leathery inner covering (endocarp) enclosing the seeds, and as such consists of seeds 37 p. c., endocarp (pod) 37 p. c., hairs 25 p. c.; the lighter in color the pappus, the higher in grade the contained seeds; occurs on the market in pods and as clean seeds.

Constituents.—Strophanthin 1–3 p. c., choline, trigonelline, fixed oil 25–30 p. c., starch, proteids, pseudo-strophanthin (?), ash 4–5 p. c.

Strophanthinum, Strophanthin, $C_{40}H_{66}O_{19}$, *official.* — (Syn., Fr. Strophantine, Inéine; Ger. Strophanthin.) This glucoside or mixture of glucosides is obtained by exhausting seeds with ether or petroleum benzin (removing fat), then extracting with 70 p. c. alcohol, reclaiming latter, dissolving residue in water, filtering; add tannin, wash precipitate, mix with litharge, dry, exhaust with alcohol, precipitate with ether; heated with diluted hydrochloric acid becomes hydrolyzed, yielding strophanthidin, $C_{27}H_{38}O_7 + 2H_2O$, which precipitates, and strophanthobiose-methyl-ether, $C_{12}H_{21}O_{10}CH_3$, remaining in solution. It is a white, yellowish powder, containing varying amounts of water, which it does not lose entirely without decomposition, permanent (must use great caution in tasting and then only in very dilute solutions), soluble in water, diluted alcohol, less so in dehydrated alcohol, nearly insoluble in chloroform, ether, benzene; solutions neutral, dextrorotatory. *Tests:* 1. With sulphuric acid—emerald-green color, changing to brown; incinerate .1 Gm.—ash non-weighable. 2. Aqueous solution with trace of ferric chloride T. S. and a few Ml. (Cc.) of sulphuric acid—red-brown precipitate, turning dark green in 1–2 hours. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{300}$–$\frac{1}{120}$ (.0002–.0005 Gm.).

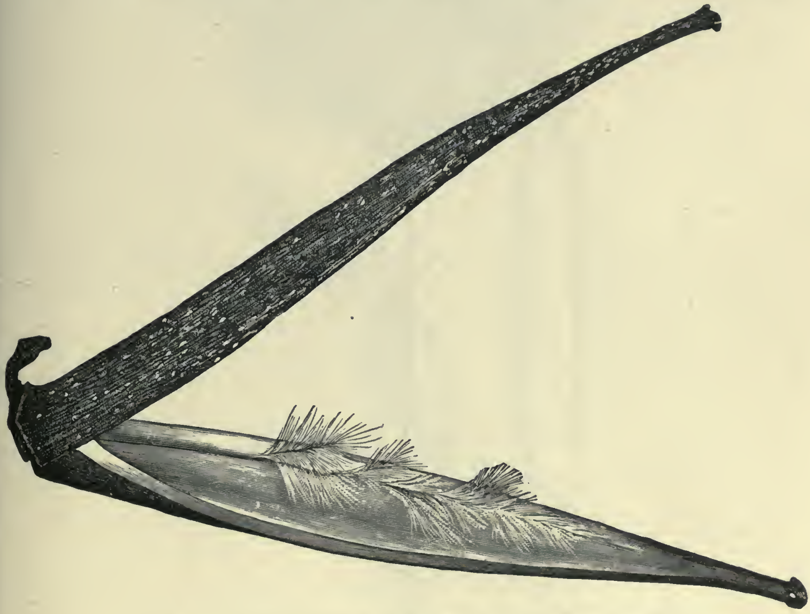


FIG. 317.—*Strophanthus Kombé:* capsule, one-half natural size.

Fixed Oil.—Brownish-green, non-drying, heavy odor, sp. gr. 0.925, contains volatile oil, phytosterin, formic acid, oleates, stearates, arachinates; may be the irritating ingredient.

PREPARATIONS.—1. *Tinctura Strophanthi.* Tincture of Strophanthus. (Syn., Tr. Strophanth.; Fr. Teinture (de Semences) de Strophanthus; Ger. Strophanthus(samen)tinktur.)

Manufacture: 10 p. c. Percolate slowly 10 Gm. with purified petroleum benzin until no greasy stain left; unpack and expose contents to air until dry and benzin odor disappeared, then proceed similar to Tinctura Veratri Viridis, page 101; menstruum: alcohol—moistening and macerating for 48 hours (instead of 24 hours) before starting percolation. Dose, ♏j–10 (.06–.6 Ml. (Cc.)).

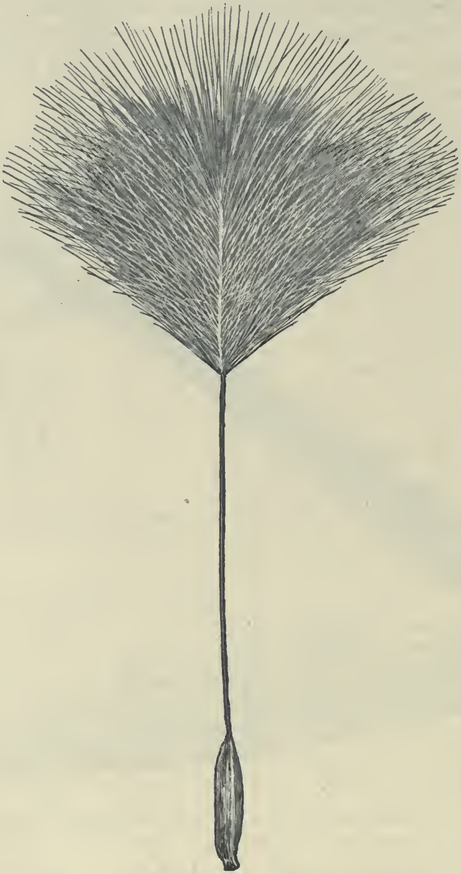


Fig. 318.—Strophanthus seed with comose awn.

Unoff. Preps.: Decoction, 1 p. c., dose, ♏x–60 (.6–4 Ml. (Cc.)). *Extractum Strophanthi* (Br.), 50 p. c., dose, gr. $\frac{1}{4}$–1 (.016–.06 Gm.). *Test:* 1. The tincture or extract + ferric chloride T. S. + sulphuric acid, gives brown precipitate changing to green after 1 hour, and so remains 3–4 hours.

Properties.—Similar to digitalis; heart stimulant, diuretic. Acts directly on muscular tissue of the heart, increasing the contractile power; small doses stimulate contractions, strengthen the force and lower the rate of heart-beats, thus prolonging diastole without altering the duration of the systole, making regular an irregular heart; large doses paralyze the heart, leaving cardiac muscle rigid. It is a better diuretic and a more powerful cardiac stimulant than digitalis, the effect coming on much more quickly, yet being less permanent; reduces pulse and temperature, but is not cumulative, nor does it occasion gastro-intestinal derangement; the increased cardiac action stimulates renal circulation, thereby causing the diuretic action.

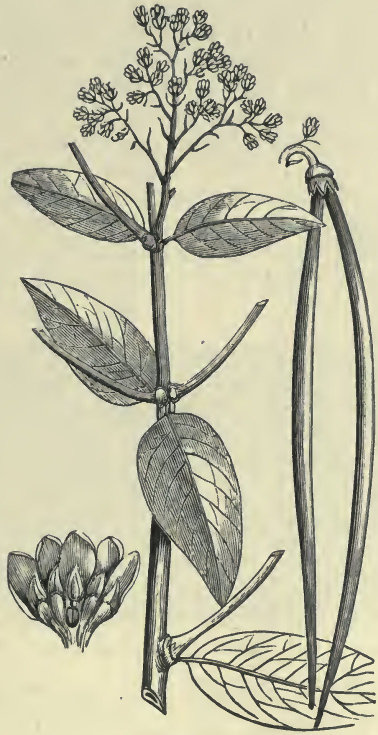


Fig. 319.—*Apocynum cannabinum.*

Uses.—Cardiac dyspnœa, chronic Bright's, valvular heart lesions, palpitation, weak heart, pulmonary œdema from pneumonia, cardiac dropsy, endocarditis, hysteria, chlorosis, renal calculi, asthma, exophthalmic goitre. The effect is felt within half an hour, lasting 4–8 hours, reducing pulse 10–30 beats, at the same time increasing force and volume. The natives make of it an arrow poison (*kombé*), which is an extract, to be applied as a coating over several inches of the pointed end. Game, when wounded, soon becomes exhausted, but flesh is not injured by the poison.

Poisoning, Incompatibles, Synergists: Same as for digitalis.

Allied Plants:

1. *Strophanthus dichot'omus, False Strophanthus Seeds.*—These are chestnut-brown and less densely covered with hairs, otherwise resemble the official.

2. *Apoc'ynum cannab'inum, Apocynum, Canadian Hemp, Dogbane.*—The dried rhizome, official 1830–1910; United States, Canada to Florida. Perennial milky-juiced herb, 1–2 M. (3–6°) high, glabrous, branched; leaves opposite, entire, mucronate; flowers, cymes, greenish-white; fruit acute follicle, 20 Cm. (8′) long, 4 Mm. ($\frac{1}{6}$′) thick. Rhizome, variable length, 3–8 Mm. ($\frac{1}{8}$–$\frac{1}{3}$′) thick, cylindical, longitudinally wrinkled, transversely fissured, yellowish, brownish, brittle; wood yellowish, radiate, porous; bark tough fibrous, containing laticiferous ducts and bitterness—50–65 p. c. of the root; solvents: boiling water alcohol (65 p. c.); contains cynotoxin (most active), apocynin, tannin, resin, starch, ash 5 p. c. Diuretic, diaphoretic, expectorant, antiperiodic, alterative, cardiac stimulant (similar to digitalis); emetic; cardiac and renal dropsy, intermittents, dyspepsia. Dose, gr. 2–5 (.13–.3 Gm.); emetic, gr. 15–30 (1–2 Gm.); fluidextract (glycerin 10, alc. 60, water 30), ♏ij–5—30 (.13–.3—2 Ml. (Cc.)); also in aqueous extract, decoction, tincture.

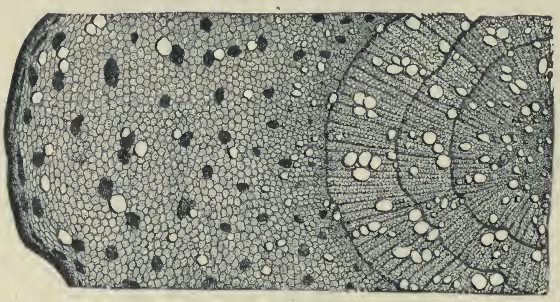


FIG. 320.—*Apocynum cannabinum:* root, transverse section, magnified 25 diam.

3. *A. androsæmifo'lium, Spreading Dogbane.*—The rhizome (root), official 1820–1880; N. America. Grows associated with the preceding, having stem more spreading, leaves broader, rhizome thinner, tougher, with central pith; bark thinner with layer of stone cells; flowers pinkish; contains (supposedly) about the same as *A. cannabinum*, causing it to be used for similar purposes, but, as a fact, it produces quite different effects.

ASPIDOSPERMA. ASPIDOSPERMA.

Aspidosperma Quebracho-blanco, *Schlechtendal.* { The dried bark, with not more than 2 p. c. of wood, foreign matter, etc.

Habitat. S. America; Argentine Republic, Chile.

Syn. Aspidosp., Quebracho, Quebracho Bark, White Quebracho; Fr. Quebracho; Ger. Quebracho.

APOCYNACEÆ

As-pi-do-sper'ma. L. fr. Gr. *ασπί(ς)δος*, a round shield, + *σπέρμα*, a seed —*i. e.*, resemblance of seed—broadly winged.

Que-bra'cho-blan'co. Pg. contr. fr. *quebrar*, to break, + *hacha*, an ax, + *blanco*, white—*i. e.*, light-colored wood, and stone cells of bark so hard as to break edges of axes, tools, etc.

PLANT.—Evergreen tree, 25–30 M. (80–100°) high, wide spreading, drooping crown and branches; wood chocolate-brown, young yellowish; leaves lanceolate, small, short petiolate, coriaceous, rigid, glaucous; flowers campanulate, yellowish, 5's, panicles; fruit July, capsule, dehiscent, pericarp thick, woody. BARK, in irregular chips, longitudinal pieces, 5–14 Cm. (2–6′) long, 10–35 Mm. ($\frac{2}{5}$–$1\frac{2}{5}'$) thick; outer corky layer 3–25 Mm. ($\frac{1}{8}$–1′) thick, reddish-brown, deeply furrowed, frequently reticulate with longitudinal and shallow transverse fissures, crevices occasionally lined with mycelia of grayish mold; outer surface of bark (after removing cork) light reddish-brown, usually rough; inner surface, sometimes with adhering wood, otherwise yellowish-brown, longitudinally finely striate and porous; fracture short-fibrous with projecting bast-fibres; fracture of entire bark reveals 2 well-defined strata of about equal thickness marked with dots, stone cells and striæ; nearly inodorous; taste bitter, slightly aromatic. POWDER, reddish-brown—bast-fibres single, long, surrounded by crystal fibres, thick groups of tabular stone cells, polygonal thick cork cells, spherical starch grains, .003–.025 Mm. ($\frac{1}{8325}$–$\frac{1}{1000}'$) broad. *Solvent:* diluted alcohol. Dose, gr. 15–30 (1–2 Gm.).

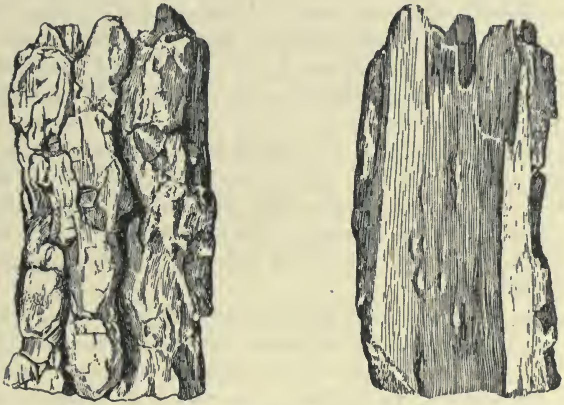


FIG. 321.—Aspidosperma ($\frac{1}{2}$ Nat.).

Commercial.—Tree resembles the weeping willow, being not only ornamental but valuable for its wood in building, carving, etc.; bark should be taken from old trees to insure well-developed corky layer; juice of the green fruit often used like rennet.

CONSTITUENTS.—Aspidospermine, $C_{22}H_{30}N_2O_2$, aspidospermatine, $C_{22}H_{28}N_2O_2$, aspidosamine, $C_{22}H_{28}N_2O_2$ (amorphous), quebrachine,

$C_{21}H_{26}N_2O_2$, quebrachamine, hypoquebrachine, $C_{21}H_{26}N_2O_2$ (amorphous), quebrachit (sugar), tannin 3–4 p. c.

Alkaloids (6).—Obtained by treating extract (hot alcohol) with sodium hydroxide and chloroform, evaporating, taking up residue with diluted sulphuric acid, precipitating filtrate with sodium hydroxide; dissolve precipitate (mixed alkaloids) in boiling alcohol and upon cooling aspidospermine, quebrachine, and quebrachamine crystallize out (separated by crystallization from diluted hydrochloric acid), aspidospermine remaining in the (acid) mother-liquor; to the alcoholic mother-liquor add acetic acid, from which aspidosamine is precipitated by ammonia water, aspidospermatine and hypoquebrachine by sodium hydroxide (separated by boiling benzin in which hypoquebrachine is insoluble); all more or less soluble in alcohol, ether, chloroform, benzin (quebrachamine the least so). Aspidospermine is the leading alkaloid (usually a mixture in commerce), being prescribed as sulphate or chloride. Dose, gr. 1–2 (.06–.13 Gm.); quebrachine, the next most important alkaloid, also forms salts. Dose, gr. $\frac{3}{4}$–$1\frac{1}{2}$ (.05–.1 Gm.).

Preparations.—1. *Fluidextractum Aspidospermatis.* Fluidextract of Aspidosperma. (Syn., Fldext. Aspidosp., Fluid Extract of Aspidosperma, Fluidextract of Quebracho; Fr. Extrait fluide de Quebracho; Ger. Quebrachofluidextrakt.)

Manufacture: Similar to Fluidextractum Ergotæ, page 60; 1st menstruum: alcohol 67 Ml. (Cc.), water 22, glycerin 11; 2nd menstruum: 67 p. c. alcohol. Dose, ♏xv–60 (1–4 Ml. (Cc.)).

Unoff. Preps.: Extract, dose, gr. 2–8 (.13–.5 Gm.). *Tincture,* 20 p. c. (diluted alcohol), dose, ʒj–4 (4–15 Ml. (Cc.)). *Wine,* 6 p. c., dose, ʒj–6 (4–24 Ml. (Cc.)).

Properties.—Cardiac and respiratory stimulant, slows and deepens breathing, antispasmodic, antiperiodic; solutions protective to wounds.

Uses.—Cardiac and asthmatic dyspnœa, phthisis, asthma from bronchitis or chronic pneumonia, shortness of breath; facilitates absorption of oxygen by the blood; if use continued have headache, vertigo, salivation, intolerance, and death from asphyxia; enables the endurance of fatigue, climbing elevations, etc.; bark natively for tanning.

Allied Plants:

1. *Quebracho Colorado* (*Loxopteryg'ium Lorent'zii—Red Quebracho*).—S. America, Bark checkered, wood red, light brown (Colorado); contains tannin 20 p. c., loxopterygine; resinous exudation of bark resembles kino; resembles official but deeper color, largely used in tanning. *Quebracho flo'ja* (*Iodi'na rhombifo'lia*), S. America, and *Copalchi Bark* (*Croton ni'veus*), Mexico. All three collected and sold as aspidosperma.

2. *Ascle'pias tubero'sa, Asclepias, Pleurisy Root.*—Asclepiadaceæ. The dried root, official 1850–1900; United States, Canada. Perennial plant with numerous stems, .6–1 M. (2–3°) high, hairy, green or reddish, differing from other asclepias in not emitting milky juice; flowers beautiful orange-red. Root, large, fusiform, in pieces 2.5–15 Cm.

(1–6′) long, 2.5 Cm. (1′) thick, head knotty, annulate, yellowish-brown, fracture tough, uneven, bark thin, wood with large medullary rays; inodorous; taste bitter, acrid; contains asclepiadin—the active glucoside, volatile oil, 2 resins, mucilage, starch, tannin, ash 9 p. c. Diaphoretic, expectorant, carminative, sudorific, anodyne, irritant; large doses emetic, cathartic; pleurisy (hence its name), pneumonia, consumption, rheumatism of chest, colic, dyspepsia, asthma, scrofula, ulcers, wounds. Dose, gr. 15–60 (1–4 Gm.); fluidextract (diluted alcohol) ʒss–1 (2–4 Ml. (Cc.)).

3. *A. incarna'ta, Flesh-colored Asclepias, Swamp Milkweed.*—The root (rhizome), official 1820–1860 and 1870–1880; Canada, United States. Perennial herb, smooth or pubescent, .6–1 M. (2–3°) high, with 2 downy lines above; very leafy; leaves lanceolate, cordate base, 10–17.5 Cm. (4–7′) long, 2.5–5 Cm. (1–2′) wide; flowers rose-purple, sweet-scented; root 2.5 Cm. (1′) long, knotty, oblong, brownish, bark thin, central pith, sweet, then acrid bitter, emits milky juice when wounded; contains volatile oil, 2 acrid resins, asclepiadin. Used as alterative, emetic, cathartic, diuretic, like *Asclepias tuberosa;* in decoction, infusion, tincture. Dose, gr. 15–40 (1–2.6 Gm.).

4. *A. syri'aca* (*Cornu'ti*), *Common Milkweed, Silkweed.*—The root (rhizome), official 1820–1860 and 1870–1880; United States. Herb 1–1.5 M. (3–5°) high, stout, pubescent, finely soft; leaves oblong, 10–20 Cm. (4–8′) long, downy beneath; flowers large, purplish-white, sweet-scented, hoods ovate with a tooth each side of stout, claw-like horn; fruit prickly pods containing much silky seed-down; root 2.5–15 Cm. (1–6′) long, 6–12 Mm. ($\frac{1}{4}$–$\frac{1}{2}$′) thick, in sections, wrinkled, knotty, brownish; bark tough, thick, with laticiferous vessels, wood-wedges yellow, bitter, nauseous; contains asclepion (tasteless), bitter, crystalline principle, caoutchouc (6 p. c. of milk-juice), resin, tannin, starch. Used like preceding, also to coat over wounds, ulcers, etc., to promote cicatrization. Dose, gr. 15–40 (1–2.6 Gm.). *A. curassav'ica, Bastard Ipecacuanha,* C. and S. America; flowers bright red; the glossy seed-hairs, called vegetable silk, firmer than the preceding; contains asclepiadin; used natively as we do *Asclepias tuberosa.*

5. *Marsde'nia* (*Gonol'obus*) *Conduran'go, Condurango.*—Ecuador. Climbing vine, 3–9 M. (10–30°) high, bark of the stem used in medicine; occurs in quills or curved pieces, periderm ash-gray, wrinkled, warty, with greenish-black lichens attached; liber pale brownish and striate, due to stone cells; odor slight; taste bitter, acrid; contains tannin, a glucoside, an alkaloid (resembling strychnine in action), resins, starch, gum, ash 12 p. c. Used for tonic, alterative, rheumatism, cancer. Dose, gr. 30 (2 Gm.); fluidextract (dil. alc.), ʒss–1 (2–4 Ml. (Cc.)).

60. CONVOLVULACEÆ. Morning-glory Family.

Kon-vol-vu-la'se-e. L. *Convolvul-us* + aceæ, fr. *convolvere,* to roll together, entwine—*i. e.,* referring to stem's twining habit. Herbs, shrubs. Distinguished by twining or trailing habit, roots, containing acrid, milky, purgative juice; leaves exstipulate, sometimes parasitic and leafless; calyx 5, imbricate, inferior; corolla regular, 5-plaited or -lobed; ovary 2–4-celled; ovules 2 in each cell; fruit capsule, 2–4-celled. Allied to Solanaceæ and Scrophulariaceæ, but differing in habit, alternate leaves, and large solitary seeds, with crumpled embryo; tropics, temperate climates; purgative (glucosides in juices); some roots edible (starch, sugar).

Genera: **1. Exogonium. 2. Convolvulus.**

JALAPA. JALAP.

Exogonium purga, (*Wenderoth*) *Bentham.* { The dried tuberous root, containing 7 p. c. of the total resins.

Habitat. E. Mexico, in damp, rich, shady woods; cultivated in India.

Syn. True Jalap, Vera Cruz Jalap, Radix Jalapæ; Fr. Jalap—tubéreux—officinal; Ger. Tubera Jalapæ, Jalapenwurzel, Jalapenknollen, Jalape.

Ex-o-go'ni-um. L. fr. Gr. ἔξω, outside, + γόνος, offspring—*i. e.*, parts of generation (stamens, pistil) exserted—extended above corolla.

Pur'ga. L. fr. *purgo, purgare*, to purge, cleans, purify—*i. e.*, its cathartic action on the system.

Jal'a-pa. L. named after *Jalapa* or *Xalapa*, a city in Mexico, whence imported.

Jal'ap. Formerly *jal'op*, English abbreviation from *Jalapa.*

Plant.—Perennial twining herb; stems numerous, slender, twisted, furrowed, smooth, purplish, 3.6–6 M. (12–20°) long, twining around neighboring objects; leaves exstipulate, 10–12.5 Cm. (4–5′) long, cordate, entire, smooth, pointed, under side paler, prominently veined, on long petioles; flowers Sept.–Nov., purple, salver-shaped, tube 5 Cm. (2′) long, limb 5–7.5 Cm. (2–3′) wide, in 3-flowered cymes, stamens exserted (*exogonium*). Root, fusiform, irregularly ovoid, pyriform, upper end more or less rounded, lower slightly tapering, 4–15 Cm. ($1\frac{3}{5}$–6′) long, 12–60 Mm. ($\frac{1}{2}$–$2\frac{2}{3}$′) thick; large roots often incised, cut into pieces; dark brown, longitudinally wrinkled or furrowed, numerous lenticels; hard, compact, non-fibrous; internally dark brown, mealy or waxy; bark 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, outer bundles separated from outer cortical layer by distinct, brown cambium zone; odor slight, distinctive, smoky; taste somewhat sweet, acrid. Powder, light brown; microscopically—numerous starch grains, .003–.035 Mm. ($\frac{1}{8325}$–$\frac{1}{725}$′) broad, calcium oxalate rosette aggregates, tracheæ, laticiferous vessels with brownish resinous masses. *Solvents:* diluted alcohol extracts virtues completely; water or alcohol alone only partially, each taking out a portion of purgative property, the alcoholic solution being more griping than the aqueous. Dose, gr. 5–20 (.3–1.3 Gm.).

Adulterations.—False Jalap roots (*Ipomœa simulans, I. orizabensis*), and roots of allied species; immature jalap roots, collected at improper times and containing very little resin; jalap roots deprived of resin by soaking in alcohol, becoming sticky to the touch, darker internally and thereby easily recognized; roots of other species of

Exogonium and *Ipomœa* genera; mealy jalap, resembling the true root, but with mealy fracture and very few resin cells.

Commercial.—Plant resembles our Morning-glory, demands rich forest-loam and a climate suitable to Cinchona; grows on the eastern slope of the Mexican Andes, 1,500–2,400 M. (5,000–8,000°) elevation, flourishes well in the Neilgherry, India, and is cultivated in Jamaica. It is trained upon trellises and various supports, and not disturbed until 3 years old and only thereafter every third year. Roots are dug in all seasons (hence varying appearance and strength), but chiefly in the spring, when young shoots appear, and in the autumn (best), after aërial stems have decayed, then washed, placed into nets and dried by holding over fire (there being no sunshine during the rainy season), which imparts a slight smoky odor and hydrates much of the starch; prior to desiccation the very large pieces are divided into

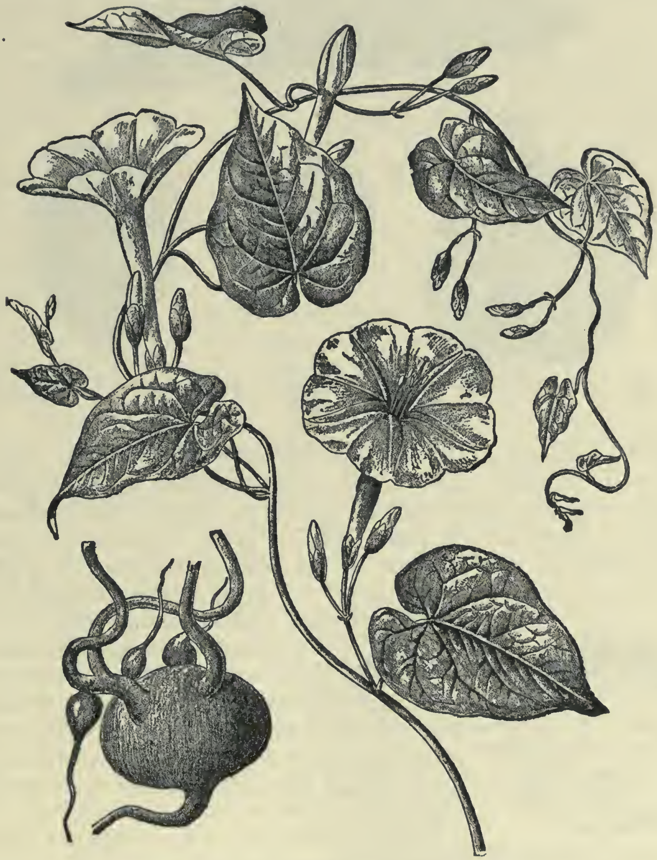


FIG. 322.—*Exogonium purga.*

halves, quarters, or transversely that tends to make it less desirable; after drying it is put into bags (100–200 pounds; 45–90 Kg.) and shipped from Vera Cruz.

Constituents.—Resin 7–15–22 p. c., starch, gum 15 p. c., sugar 2 p. c., bassorin, coloring matter, ash 5–6.5 p. c.

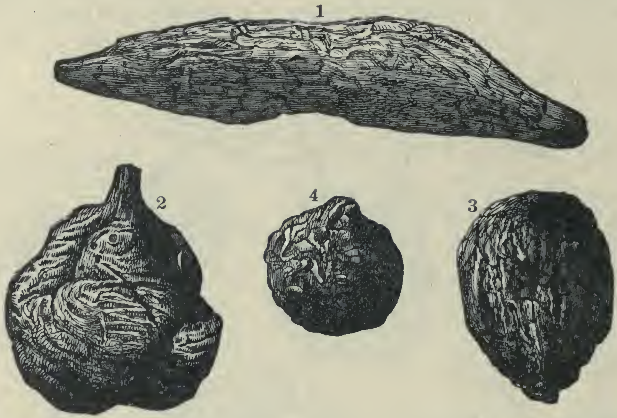


Fig. 323.—Jalap tubers, small sized: *1*, fusiform; *2*, pear-shaped; *3*, date-shaped; *4*, globular.

Resin.—Consists of: 1. *Jalapin* (probably identical with scammonin), 4–10 p. c., soft, waxy, soluble in ether, alkalies, reprecipitated by acids, and medicinally inert. 2. *Jalapurgin, rhodeoretin, convolvulin,* $C_{62}H_{100}O_{32}$, 90–96 p. c., a white, odorless glucoside, hard, insoluble in ether, soluble in alkalies, more of an irritant than jalapin, and the chief active constituent; converted by alkalies into jalapurgic (convolvul(in)ic acid, which is soluble in water), $C_{28}H_{52}O_{14}$, by warming with diluted acids or emulsion into glucose, volatile methyl-ethyl-acetic acid, $C_5H_{10}O_2$, and convolvulic acid, and this latter by continued action into glucose and crystalline convolvulinolic acid, $C_{16}H_{30}O_3$; the name jalapin has unfortunately been assigned to both resins.

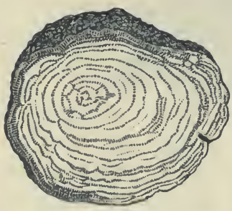


Fig. 324.—Jalap tuber: transverse section.

Preparations.—1. *Pulvis Jalapæ Compositus.* Compound Powder of Jalap. (Syn., Pulv. Jalap. Co., Pulvis Purgans—Catharticus or Jalapæ tartaratus; Fr. Poudre de Jalap composée; Ger. Jalapenpulver mit Weinstein.)

Manufacture: 35 p. c. Triturate together jalap 35 Gm., potassium bitartrate 65 Gm.; mix thoroughly, pass through No. 60 sieve. It is light brown; microscopically—numerous angular, rectangular fragments slowly soluble in water or hydrated chloral T. S., strongly polarizing light with display of colors (potassium bitartrate), numerous starch grains, .003–.035 Mm. ($\frac{1}{8325}$–$\frac{1}{725}$′) broad, few fragments of jalap with laticiferous vessels and parenchyma having tracheæ and rosette aggregates of calcium oxalate. Dose, gr. 15–60 (1–4 Gm.).

2. *Resina Jalapæ.* Resin of Jalap. (Syn., Res. Jalap.; Br. Jalapæ Resina; Fr. Résine de Jalap; Ger. Jalapenharz.)

Manufacture: Macerate, percolate 100 Gm. with alcohol until the percolate when dropped into water only produces slight turbidity (250 Ml. (Cc.)), reclaim alcohol until percolate reduced to 25 Gm., and add this, constantly stirring, to water 300 Ml. (Cc.), let precipitate subside, decant supernatant liquid, wash precipitate twice by decantation, each time with water 100 Ml. (Cc.), drain, dry on water-bath. It is in yellowish-brown masses, fragments, breaking with resinous, glossy fracture, translucent at edges, or yellowish-brown powder, slight, peculiar odor, somewhat acrid taste, permanent, soluble in alcohol, insoluble in carbon disulphide, benzene, fixed or volatile oils; alcoholic solution faintly acid. *Tests:* 1. Shake occasionally for an hour in a stoppered flask 1 Gm. with 10 Ml. (Cc.) of chloroform, evaporate filtrate, dry residue—should weigh .3 Gm. 2. Dissolve in ammonia water (5)—solution not gelatinous on standing; acidify with hydrochloric acid—only slight turbidity (abs. of rosin, guaiac, resins). *Impurities:* Rosin, guaiac, aloin, acid resins, orizaba, other resins, water, soluble substances. Dose. gr. 1–5 (.06–.3 Gm.).

Prep.: 1. *Pilulæ Catharticæ Compositæ,* resin of jalap $\frac{1}{3}$ gr. (.02 Gm.).

Unoff. Preps.: Abstract (alcohol), dose, gr. 2–5 (.13–.3 Gm.). *Extract* (alcohol), dose, gr. 2–10 (.13–.6 Gm.). *Fluidextract* (alcohol), dose, ♏ij–10 (.13–.6 Ml. (Cc.)). *Tinctura Jalapæ* 20 p. c. (67 p. c. alcohol), dose, ʒss–1 (2–4 Ml. (Cc.)). *Tinctura Jalapæ Composita,* 12.5 p. c., + resin of scammony 3 p. c., 67 p. c. alcohol q. s., dose, ʒss–1 (2–4 Ml. (Cc.)).

PROPERTIES.—Hydragogue cathartic, diuretic. Has no effect until the duodenum is reached, where with the bile it forms a purgative compound that stimulates vascularity, peristalsis, and profuse secretion from intestinal glands, with no action on biliary flow; usually acts in 4 hours. It is less irritating than gamboge, podophyllum, or scammony, but occasionally gripes, nauseates, and vomits. Often given to children for worms, as it has little taste and a safe action. Excessive doses produce dangerous hypercatharsis. Jalapurgin (convolvulin) in large doses is likewise an active irritant or poison.

USES.—Dropsy, constipation, in febrile and inflammatory affections, head troubles; was introduced into Europe early in the 17th century, and is even now quite popular, being combined usually with calomel, cream of tartar, etc.

Allied Plants:

1. *Ipomœ'a pandura'ta* (*Convolvulus pandura'tus*), *Wild Potato* or *Jalap, Man Root, Man of the Earth.*—The root, official 1820–1860; United States. Plant recognized by its fiddle-shaped leaves, stem purplish, climbing 3.5–4.5 M. (12–15°) high; flowers campanulate,

white, purplish; root conical, .6–1 M. (2–3°) long, 5–7.5 Cm. (2–3′) thick, in slices, wrinkled, brownish-yellow, milky inside, bark thin with a zone of resin-cells, odor slight, taste sweetish, bitter, acrid; contains resin 1–2 p. c. (glucoside). Used as diuretic, cathartic in strangury, calculi. Dose, gr. 15–60 (1–4 Gm.).

False Jalaps:

1. *Ipomœa sim′ulans, Tampico Jalap.*—Root irregularly globular or elongated deeply wrinkled, no transverse ridges—as in the official; yields resin (*tampicin*) 10–15 p. c., nearly all being soluble in ether, and believed identical with resin of scammony.

2. *I. orizaben′sis, Fusiform* (*False, Male*) *Jalap.*—Root spindle-shaped, .6 M. (2°) long, strong radiate structure with projecting fibres on transverse fracture, large, woody, often cut into slices 5–7.5 Cm. (2–3′) broad, dark brown, broad concentric rings, coarse projecting fibres, and exported liberally for its resin, *jalapin, orizabin*—false scammony—of which it contains 17 p. c., resembling closely genuine scammony, but entirely soluble in ether, and believed identical with tampicin. It is unfortunate that the resin of this plant received the name *jalapin* primarily, as it thus precludes in a sense its application to the resin of the official drug. The synonym *orizabin*, as proposed and named by Flückiger, may sometime be accepted here, and thus allow the term *jalapin* to be used where it would seem more properly to belong.

3. *Convol′vulus Mechoacan′na, Mechoacanna Root.*—Considered by some identical with *Ipomœa pandurata;* occurs in sections, light, whitish, mealy, contains little resin.

SCAMMONIÆ RADIX. SCAMMONY ROOT.

Convolvulus Scammonia, *Linné.* } The dried root, containing 8 p. c. of resins.

Habitat. W. Asia (Syria, Asia Minor, Anatolia), Greece (Archipelago); cultivated.

Syn. Scam. Rad.; Fr. Racine de Scammonée; Ger. Scammoniawurzel, Scammoniawinde, Purgierwinde, Scammony-bindweed.

Con-vol′vu-lus. L. bindweed, see etymology, page 489, of Convolvulaceæ.

Scam-mo′ni-a. L. fr. Gr. *σκάμβος*, crooked—*i. e.*, its stems are crooked; *σκαμμωνία*, classic name, Pers. origin.

Plant.—Perennial twining herb, stems numerous from crown of root, slender, 6–9 M. (20–30°) long; leaves sagittate, bright green, petioles long; flowers, July–Sept., large, numerous, pale yellow, funnel-shaped, 4–5 Cm. (1⅗–2′) broad, on long stalks; fruit capsule, ovate, 12 Mm. (½′) long, 4-seeded. Root, vertical, cylindrical, somewhat tapering, 10–25 Cm. (4–10′) long, 1–4.5 Cm. (⅖–1⅘′) thick, grayish-brown, reddish-brown, usually distinctly twisted, deeply longitudinally furrowed, distinct root-scars, otherwise nearly smooth except for lenticels and abraded cork, upper portion terminated generally by a number of short stem branches; hard, heavy; fracture tough, irregular with projecting wood-fibres; internally mottled, showing yellowish, porous, wood-wedges separated by whitish parenchyma, containing starch and resin, bark thin; odor slight, jalap-like; taste very slightly sweet and acrid. POWDER, light grayish-brown, microscopically—starch grains, .003–.018 Mm. ($\frac{1}{8325}$–$\frac{1}{1375}$′) broad, monoclinic prisms of calcium oxalate, fragments of leptomes or sieve with resin cells, tracheæ, short wood-fibres, stone cells, few lignified cork cells. *Solvents:* alcohol; ether. Dose, gr. 5–20 (.3–1.3 Gm.).

Commercial.—Plant twines around near objects, and is richest in resin just before flowering, when the root should be dug, properly prepared and dried for market. The once official (1820–1910) gum-resin, *scammonium; scammony,* was subject to much adulteration and irregularity in consequence of which it has been discarded. It is still an article of commerce under its two varieties: 1. Genuine, best; 2, Virgin (Smyrna, Aleppo), being collected very similar to asafetida by laying bare and slicing upper portion of root, catching in mussel shells the creamy exudate, which contains resin 70–90 p. c., gum 3–8 p. c.; in drying often undergoes fermentation rendering it porous, dark, moldy, and of cheesy odor.

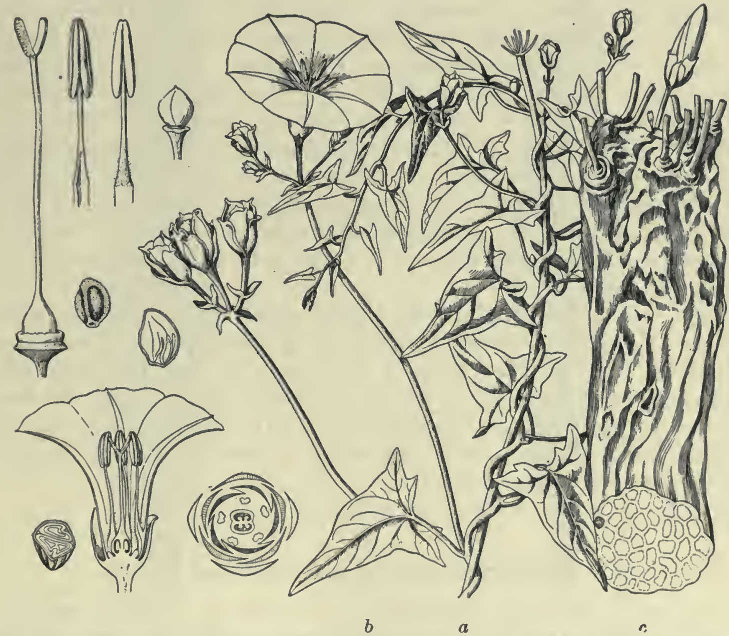


FIG. 325.—*Convolvulus Scammonia: a,* blooming plant; *b,* fruiting twig; *c,* root (½ natural size); also flower, anther, pistil, fruit, seed, diagram of flower, enlarged.

CONSTITUENTS.—Resin 3–10 p. c., gum, tannin 3 p. c., sugar 15 p. c., starch, extractive.

Resin, $C_{34}H_{56}O_{16}$.—Identical with orizabin (jalapin of *Ipomœa orizabensis—False* or *Mexican Scammony Root*), being an ether-soluble glucosidal resin, anhydride of scammonic acid, into which it is converted by alkalies, thence becoming soluble in water.

PREPARATIONS.—1. *Resina Scammoniæ.* Resin of Scammony. (Syn., Res. Scamm., Scammonin; Br. Scammoniæ Resina; Fr. Résine de Scammonée; Ger. Scammoniaharz.)

Manufacture: Macerate, percolate 100 Gm. with alcohol until percolate when dropped into water only produces slight turbidity, reclaim alcohol until percolate the consistence of thin syrup, and pour this slowly, constantly stirring, into hot water 100 Ml. (Cc.), let precipitate subside, decant supernatant liquid, wash precipitate twice by decantation, each time with hot water 100 Ml. (Cc.), dry on water-bath. It is in brownish, translucent masses, fragments, breaking with glossy, resinous fracture, odor characteristic, agreeable, soluble in alcohol; 95 p. c. soluble in ether (dist. from resins of jalap and false scammony—orizaba). *Impurities:* Guaiac, rosin, resin of jalap, resin of orizaba; ash 1 p. c.; does not yield green emulsion with water (dif. from gum-resin of scammony). Dose, gr. 3–8 (.2–.5 Gm.).

Prep.: 1. *Extractum Colocynthidis Compositum*, 14 p. c. (resin).

Unoff. Preps.: Pilula Scammonii Composita, resin + jalap resin, each 16 p. c., dose, gr. 4–8 (.26–.5 Gm.). *Pulvis Scammoniæ Compositus* (Br.), resin 50 p. c. + jalap 35, ginger 15, dose, gr. 10–20 (.6–1.3 Gm.). *Emulsion.* In pill-form usually inactive, unless in combination.

PROPERTIES.—Hydragogue, cholagogue cathartic; only acts locally on the upper intestine, consequently resembles jalap, but is a more active irritant, causing much griping, owing to which it is combined generally with potassium sulphate, calomel, colocynth, jalap, aromatics, demulcents, etc.

USES.—Dropsies, cerebral affections, torpid intestines with slimy mucus. Gum-resin somewhat uncertain in action, owing to frequent impurities and difficult solubility in the system, yet the small dose and slight taste commend it for administration to children; the root, or even calomel, jalap, or gamboge, is to be preferred. It was known to the Greeks, Romans, and Arabians as a purgative, remedy for skin diseases, and as a fatal irritant.

Poisoning: Same as for aloes, colocynth, etc.

61. HYDROPHYLLACEÆ. Waterleaf Family.

Hi-dro-fil-la′se-e. L. *Hydrophyll′um* + aceæ, fr. Gr. ὕδωρ, water, + φύλλον, L. *folium*, a leaf—*i. e.*, each leaf has a cavity for holding water. Herbs, shrubs, small trees. Distinguished by being hairy, juicy, leaves hairy, toothed, lobed, pinnately compound; flowers regular, scorpioidal, 5's; ovary 1–2-celled, 2 parietal placentas, styles and stigmas 2; ovules 2–many; fruit, capsule, 2-valved; temperate climates; stimulant, astringent.

Genus: **1. Eriodictyon.**

ERIODICTYON. ERIODICTYON.

Eriodictyon californicum, *(Hooker et Arnott) Greene.* The dried leaves, with not more than 5 p. c. of stems, foreign matter.

Habitat. California, Northern Mexico; dry hills, mountains.

Syn. Eriodict. Yerba Santa, Bear's-, Consumptive's- or Tar Weed, Mountain Balm, Gum Plant, Gum-bush.

Er-i-o-dic′ty-on. L. fr. Gr. ἔριον, wool, + δίκτυον, a net—*i. e.*, woolly, net-veined leaves.

Cal-i-for′ni-cum. L. *californicus*, California, of or belonging to California—*i. e.*, its habitat.

Plant.—Evergreen shrub, 1–1.5 M. (3–5°) high; stem smooth, resinous; flowers 12 Mm. ($\frac{1}{2}'$) long, bluish-purple, funnel-shaped, 5's, racemes. Leaves, lanceolate, 5–15 Cm. (2–6′) long, 1–3 Cm. ($\frac{2}{5}$–$1\frac{1}{5}'$) broad, acute, base slightly tapering into short broad petiole, irregularly serrate, crenate-dentate; upper surface yellowish-green, covered with a more or less glistening resin; under surface yellowish-white, conspicuously reticulate with greenish-yellow veins; minutely tomentose between the reticulations; thick, brittle; odor aromatic; taste balsamic,

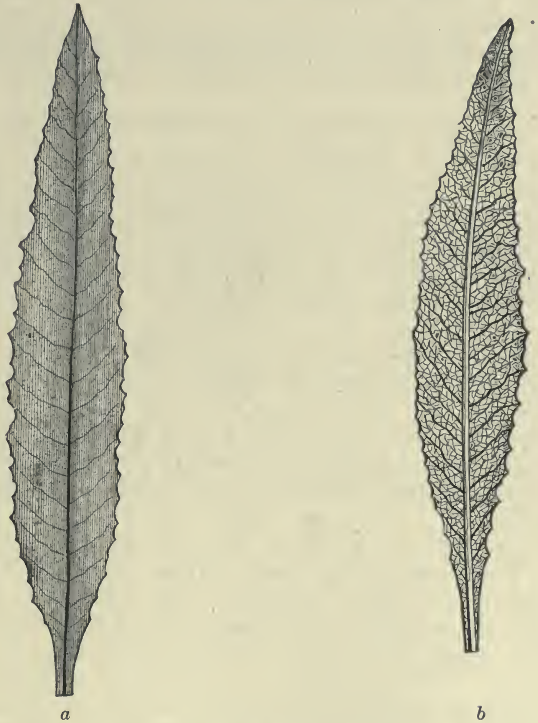


Fig. 326.—Eriodictyon leaves, natural size: *a*, upper surface; *b*, under surface.

bitter, sweetish; usually in fragments. Powder, greenish-gray; microscopically—fragments with epidermal cells, glandular hairs, 1-celled stalks, 6–8-celled glandular heads, chloroplastids, non-glandular hairs, fragments of cork, bast-fibres, sieve tissues, tracheæ, wood-fibres, pith. *Solvent:* alcohol (80 p. c.). Dose, ʒss–1 (2–4 Gm.).

Commercial.—Plant grows among rocks and presents a striking appearance from its shining resinous coating on all green parts.

Constituents.—Volatile oil .1 p. c., resin (complex, nearly soluble in ether) 30 p. c., triacontane, $C_{30}H_{62}$, pentatriacontane, $C_{35}H_{72}$, eriodictyol, $C_{15}H_{12}O_6$, homoeriodictyol, $C_{16}H_{14}O_6$, phenol, $C_{16}H_{41}O_6$, .23 p. c., glucose, phytosterol, tannin, gum.

Preparations.—1. *Fluidextractum Eriodictyi.* Fluidextract of Eriodictyon. (Syn., Fldext. Eriodict., Fluid Extract of Eriodictyon, Fluidextract of Yerba Santa; Fr. Extrait fluide d'Eriodictyon; Ger. Eriodictyonfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: 80 p. c. alcohol; reserve first 80 Ml. (Cc.). Dose, ♏xv–60 (1–4 Ml. (Cc.)).

Unoff. Preps.: Aromatic Elixir, 6 p. c. (fldext.), + syrup 50, comp. elixir of taraxacum 44, magnesium carbonate 1, pumice 3, dose, ʒj–2 (4–8 Ml. (Cc.)). *Extract,* dose, gr. 2–10 (.13–.6 Gm.). *Syrup* (made like syrup of tolu—pineapple odor and taste). *Aromatic Syrup,* 3.2 p. c. (fldext.), + potassium hydroxide solution 2.5, comp. tinct. of cardamom 6.5, oil of sassafras .05, oil of lemon .05, oil of clove .1, alcohol 3.2, sugar 80 Gm., magnesium carbonate .5, water q. s. 100; dose, ʒj–2 (4–8 Ml. (Cc.)).

Properties.—Stimulating expectorant, bitter tonic.

Uses.—Bronchitis, asthma, to disguise bitterness of quinine.

Allied Plants:

1. *Eriodictyon tomento'sum.*—Grows along with official, and differs in being larger and in having a dense coat of short villous hairs, which become whitish or rust-colored by age; corolla salver-form; leaves oval, obtuse.

2. *Verbe'na hasta'ta, Verbena, Blue Vervain.*—Verbenaceæ; N. America. The dried overground portion—stem stout, .5–2 M. (18–80′) high, square, rough, pubescent, leaves 7–15 Cm. (3–6′) long, lanceolate, acute, serrate, lobed, deep green, petiolate; flowers panicles, spikes; corolla salver-form, 5-lobed, bright blue, didynamous; fruit 4-seeded, 4 nutlets at maturity; odor heavy, taste bitter, astringent, disagreeable; contains bitter glucoside, tannin; solvent: water. Diaphoretic, expectorant, nauseant, antiperiodic, similar to eupatorium. Dose, gr. 15–30 (1–2 Gm.; fluidextract (dil. alc.); infusion, 5 p. c.

62. LABIATÆ. Labiate (Mint) Family.

La-bi-a'te. L. *Labi-um(-a)* + atæ, fem. pl. of *labiatus,* lip, lips, lipped—*i. e.,* referring to the irregular or lipped corolla. Herbs, shrubs. Distinguished by abounding in aromatic, stimulant, volatile oils, bitter extractive; stems square, calyx regular, 2-lipped, 5-toothed, corolla irregular, 2-lipped, 4–5-lobed, stamens 4, didynamous, or by abortion 2; leaves opposite, aromatic; ovary 4-lobed, becoming in fruit 4 seed-like monospermous nutlets or achens, enclosed by persistent calyx; temperate climates; aromatic, carminative, stimulant (vol. oil), tonic, stomachic (bitter extractive principle), flavoring, perfumery.

Genera: **1. Thymus. 2. Mentha. 3. Lavandula. 4. Rosmarinus.**

THYMUS. THYME.

Oleum Thymi. Oil of Thyme, *official.*

Thymus vulgaris, *Linné.* { A volatile oil distilled from the flowering plant, containing 20 p. c., by volume, of phenols.

Habitat. S. Europe (Portugal to Greece); cultivated in gardens, etc.

Syn. Common Garden Thyme, Mother of Thyme; Ol. Thymi, Thyme Oil; Fr. Thym; Essence de Thym; Ger. Herba Thymi, Thymian; Thymianöl.

Thy′mus. L. fr. Gr. θυμός, strength, its invigorating smell. Used in temples as incense.

Vul-ga′ris. L. ordinary, common—*i. e.*, the kind growing wild and in common use.

Plant.—Small shrub, 25–30 Cm. (10–12′) high; stem and branches quadrangular; bark pale brown, shoots purplish; leaves 6–12 Mm. (¼–½′) long, oval, blunt, entire, margin revolute, thick, smooth, dotted with many oil-glands, paler, pubescent beneath; flowers June–July, polygamous, cymes, forming capitate heads, pale purple. Entire plant aromatic, peculiarly attractive to bees, flies, etc.

Constituents.—Volatile oil 2.5 p. c. (thymol), resin, tannin, gum.

Oleum Thymi. Oil of Thyme.—This volatile oil is a colorless, red liquid, characteristic odor and taste, darker and thicker with age, soluble in 2 vols. of 80 p. c. alcohol, sp. gr. 0.912, lævorotatory; contains at least 20 p. c., by volume, of phenols, also cymene, $C_{10}H_{14}$, *l*-pinene, borneol, linalool; the phenol content in the French and German oil, amounting to 25–42 p. c., is mostly thymol, but sometimes carvacrol, or a mixture of the two, whereas in the Spanish oil it is chiefly carvacrol, amounting to 50–70 p. c. *Test:* 1. Shake 1 Ml. (Cc.) with hot distilled water 10 Ml. (Cc.), cool, pass aqueous layer through a wetted filter—filtrate not blue or violet with a drop of ferric chloride T. S. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

Adulterations.—Oil of turpentine, which lowers specific gravity, increases angle of rotation; wild thyme oil only increases angle of rotation.

Thymol. Thymol, $C_{10}H_{14}O$, *official.*—(Syn., Acidum Thymicum, Thymic Acid, Methyl-propyl phenol; Fr. Acide Thymique; Ger. Thymolum, Thymiansäure.) This phenol (monotomic) occurs in the volatile oil of *T. vulgaris*, and some other volatile oils, especially *Monarda punctata*, and *Ptycho′tis Cop′tica* (*Ajowan*—Umbelliferæ), the latter alone supplying most of the commercial article. It is obtained from any of these oils by distillation at 200° C. (392° F.), the more fluid distillate (hydrocarbons) being saved for various purposes, and the residue subjected to freezing, whereby thymol crystallizes out; or may agitate this residue with sodium hydroxide solution, and after a time add hot water to separate sodium-thymol ($NaC_{10}H_{13}O$) solution from thymene and to allow the unattacked oil to float on top; to sodium hydroxide solution add hydrochloric acid, which sets thymol free; purify by distillation and crystallization, decolorizing, if necessary, with animal charcoal; yield 20–61 p. c. It is in large colorless, translucent, rhombic prisms, aromatic, thyme-like odor, pungent, aromatic taste, very slight caustic effect upon the lips; soluble in glacial acetic acid, fixed or volatile oils, water (1010), alcohol (1), chloroform (.7), ether (1.5), olive oil (1.7); alcoholic solution (1 in 20) neutral, optically inactive; isomeric with carvone (carvol, carvacrol); as a solid heavier than water, when liquefied by fusion lighter than water, melts at 50° C. (122° F.); liquefies when triturated with equal weight of camphor or menthol. *Tests:* 1. Dissolve a small crystal in glacial acetic acid 1 Ml. (Cc.), add sulphuric acid 6 drops and nitric acid 1 drop—liquid deep bluish-green by reflected light. 2. Heat 1 Gm. with 5 Ml. (Cc.) of a 10 p. c. solution of sodium hydroxide—clear, colorless, or pale red solution, darker on standing, without separating oily drops; add few drops of chloroform, agitate—violet color; volatilize 2 Gm. on water-bath—residue .05 p. c. 3. Alcoholic solution (1 in 20), + ferric chloride T. S.—not violet (abs. of

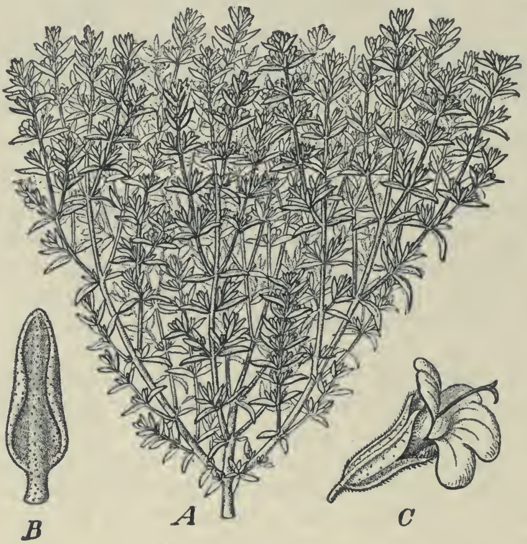


Fig. 327.—*Thymus vulgaris: A*, plant in bloom: *B*, leaf seen from under surface, magnified 4 diam.; *C*, flower seen from the side, magnified 5 diam.

phenol). *Impurities:* Phenol, etc. Should be kept in well-closed containers. Dose, antiseptic, gr. 1–5 (.06–.3 Gm.); anthelmintic, gr. 15 (1 Gm.), per die.

Unoff. Preps.: OIL: *Capsules, Pills.;* THYMOL: *Solution,* for antiseptic spray (1 to 1000), *Nebula Thymolis,* 1 p. c., + light liquid petrolatum 100. *Ointment,* 1–5 p. c. *Inhalation,* 1 gr. (.06 Gm.) to each. *Antiseptic Fluid,* 1 p. c. PLANT: *Fluidextract* (glycerin 10, alcohol 25, water 65); dose, ♏xv–60 (1–4 Ml. (Cc.)).

PROPERTIES.—1. OIL: Stimulant, tonic, emmenagogue, antispasmodic. If excessive doses given, have vomiting, depression, coldness, death by exhaustion, increased urine, which acquires green color and violet odor. II. THYMOL: Stimulant, antiseptic, deodorant, disinfectant, parasiticide, antipyretic, local anæsthetic. Its action stands between phenol and oil of turpentine, being 10 times less poisonous than the former, yet a far more powerful and permanent antiseptic; it is anæsthetic to the skin and mucous membranes, paralyzing the ends of sensory nerves; it is eliminated by breath and urine.

USES.—I. OIL: Chlorosis, rheumatism, neuralgia, bronchitis, diarrhœa, gleet, gonorrhœa, leucorrhœa, vesical catarrh; externally in baths, lotions for scabies, muscular rheumatism, to correct fetor from sores, ulcers, gangrene. Applied to cotton for toothache, earache, for veterinary practice, scenting soap. II. THYMOL: Precisely like the oil, not much internally—anthelmintic, etc., but externally as an antiseptic in surgery, to lessen fetor from sores, ulcers, gangrene, in stomatitis, diphtheria, fetid bronchitis, coryza, rhinitis, ozæna, conjunctivitis, otorrhœa, gonorrhœa, uterine lochia, cancer, leucorrhœa, warts, skin diseases (psoriasis, eczema, etc.), diarrhœa, dysentery, typhoid fever, diabetes. A good dressing is thymol 1 Gm., alcohol 10 Ml. (Cc.), glycerin 30, water q. s. 1,000 Ml. (Cc.). Flies are fond of and often become attracted by it, which is its only objection.

Thymacetin, $C_6H_2.CH_3OC_2H_5C_3H_7NH.COCH_3$, a derivative, has the same relation to thymol that phenacetin has to phenol, and is prepared similarly; it is a white crystalline powder, soluble in alcohol, slightly in water. Analgesic, hypnotic, antiseptic; used in neuralgic headache like phenacetin. Dose, gr. 5–15 (.3–1 Gm.).

Thyme plant (fresh) is used as a condiment to aid digestion of fat pork, goose, duck, etc., and to flavor insipid dishes, as is sage, marjoram, parsley; it is used also with other aromatic herbs in baths, cataplasms, fomentations, for rheumatism, gout, scabies, indolent ulcers.

Allied Plants:

1. *Scutella'ria laterifio'ra, (Mad-dog) Skullcap.*—The dried plant, official 1860–1910; N. America, United States, damp thickets, ditch banks. Perennial herb .3–.6 M. (1–2°) high; stem branched, smooth, quadrangular; leaves opposite, 5 Cm. (2′) long, ovate-lanceolate, acuminate, coarsely serrate, rounded at base, petiolate; flowers 6 Mm. (¼′) long, 1-sided axillary leafy racemes, pale blue corolla and bilabiate calyx, closed in fruit, upper lip helmet-shaped, including 4 didynamous stamens (upper pair shorter); odor slight; taste bitter;

solvents: diluted alcohol, boiling water; contains scutellarin, volatile oil, tannin, sugar. Tonic, nervine, antispasmodic; epilepsy, hysteria, nervous exhaustion, chorea, delirium tremens, tremors, spasms, muscular twitching, hyperæsthesia, neuralgia, convulsions, intermittents, enuresis, hydrophobia. Dose, ʒss–1 (2–4 Gm.); decoction, 5 p. c., ℥j–2 (30–60 Ml. (Cc.)); extract, gr. 5–10 (.3–.6 Gm.); fluidextract (diluted alcohol), ʒss–1 (2–4 Ml. (Cc.)). S. *integrifo'lia*, hairy, racemes terminal, *S. pilo'sa*, hairy, racemes terminal, leaves in distant pairs, *S. galericula'ta*, nearly smooth, flowers single, axillary; all used interchangeably.

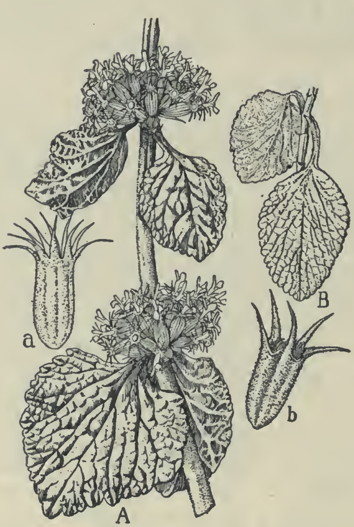


FIG. 328.—*A*, *Marrubium vulgare* (Nat.); *a*, calyx (× 3). *B*, spurious marrubium (Nat.); *b*, calyx (× 3).

2. *Marru'bium vulga're*, (*White, Common*) *Horehound*.—The dried leaves and flowering tops, official 1820–1910; Europe, C. Asia, N. America, cultivated in waste places, gardens, etc. Perennial herb .3–.6 M. (1–2°) high, with short rootstock; stems numerous, annual, branched below, quadrangular, tomentose, woolly; leaves 1.5–5 Cm. ($\frac{3}{5}$–2′) long, opposite, petiolate, roundish-ovate, obtuse, coarsely crenate, strongly rugose-veined, white-hairy; flowers whitish, in dense, axillary whorls, calyx 10-toothed, divisions slightly unequal, erect-spreading, pungent; corolla small, bilabiate, 4 included stamens; fruit of 4 ovoid, obtuse, nearly smooth nutlets, 1.5 Mm. ($\frac{1}{16}$′) long; odor distinct, agreeable; taste aromatic, bitter; solvents: diluted alcohol, boiling water; contains volatile oil, marrubiin (bitter amaroid), $C_{21}H_{28}O_4$, .02–4 p. c., resin, tannin, gum, albumin, salts. Stimulant, tonic, bitter stomachic, resolvent, anthelmintic (large doses—diuretic, diaphoretic, laxative); dyspepsia, bronchitis, chronic hepatitis, jaundice, amenorrhœa, phthisis, cachexia, catarrh, chronic rheumatism, inter-

mittents. Dose, ʒss–1 (2–4 Gm.); extract, gr. 5–10 (.3–.6 Gm.); fluidextract, ʒss–1 (2–4 Ml. (Cc.)); infusion (sweetened and flavored to liking), 5 p. c., ℥j–2 (30–60 Ml. (Cc.)); juice (succus marrubii), ʒj–2 (4–8 Ml. (Cc.)), in honey or milk; owing to bitterness, the lozenge (cough drop) is the most popular form for administration.

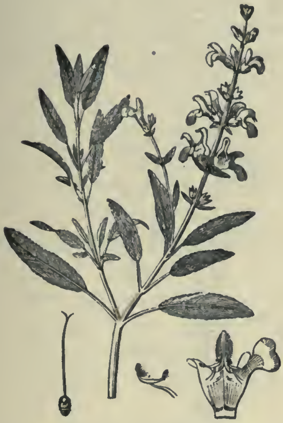


Fig. 329.—*Salvia officinalis.*

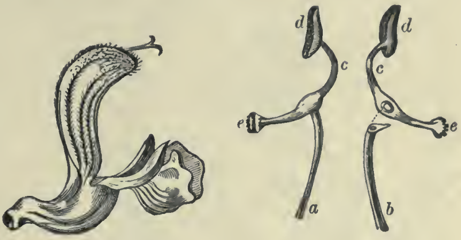


Fig. 330. — *Salvia officinalis,* flower: *a, b,* filaments; *c,* connective; *d,* fertile anthers; *e,* sterile anthers.

3. *Nep'eta Cata'ria, Catnep, Catnip, Catmint.*—The dried leaves and flowering tops, official 1840–1880; Asia, Europe; naturalized in United States. Perennial herb; stem quadrangular, branching, hoary, pubescent, .6–1 M. (2–3°) high, leaves 5 Cm. (2′) long, triangular, ovate, cordate, serrate, hairy, flowers whitish or pale pink, dotted with lilac, calyx 5-toothed, 2-lipped, stamens 4, didynamous, odor mint-like, bitter, aromatic, camphoraceous, pungent; contains volatile oil, bitter principle, tannin. Used as carminative, stimulant, tonic, diaphoretic, emmenagogue, antispasmodic for hysteria, chlorosis, colic, amenorrhœa, toothache; fluidextract (45 p. c. alcohol), decoction, infusion. Dose, gr. 15–60 (1–4 Gm.). Cats eat it ravenously, being fond of it because of its aphrodisiac effect. *Prunel'la (Brunel'la) vulga'ris, Self-heal, Heal-all.* Plant .3 M. (1°) high, flowers purplish-blue, in dense spike, leaves hairy, bitter, astringent.

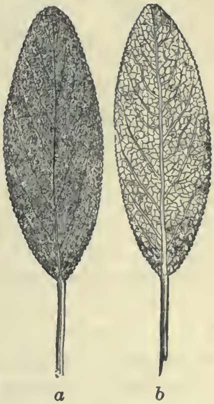


Fig. 331.—Sage leaf: *a,* upper surface; *b,* lower surface.

4. *Sal'via officina'lis, (Garden, Meadow) Sage.*—The dried leaves, official 1840–1910; S. Europe, warm stony places; cultivated universally. Perennial; stem semi-shrubby, .6 M. (2°) high, quadrangular, gray-pubescent, branched; flowers, cymes, blue with white and purple, on woolly stalks, calyx tubular, 2-lipped, upper with 3, lower with

2 acute teeth; corolla tubular, bilabiate, lower in 3 rounded lobes, central one largest; fruit 4 achenes; seed solitary. Leaves ovate-oblong, 3–7.5 Cm. ($1\frac{1}{5}$–3′) long, apex subacute, base subcordate, crenulate, thick, grayish-green, reticulate-veined, pubescent, petiolate; odor aromatic; taste aromatic, bitter, astringent; should be collected when flowering and dried carefully; solvents: diluted alcohol, boiling water; contains volatile oil .5–2 p. c., resin, tannin, bitter principle (similar to amaroid marrubiin), gum. Stimulant, tonic, astringent, vulnerary, condiment; dyspepsia, colliquative sweats, seasoning fat fowl, pork; infusion (externally)—ulcers of mouth, throat, indurated sores, nasal catarrh, suppression of mammary secretion; gargle may be sweetened (sugar, honey) and have added vinegar, alum, borax, potassium chlorate, etc.; ancients valued it highly. Dose, gr. 15–60 (1–4 Gm.); fluidextract, ♏xv–60 (1–4 Ml. (Cc.)); infusion, 5 p. c., ℥j–2 (30–60 Ml. (Cc.)); water (aqua salviæ), distil 1 part with water 10; gargle. *S. praten'sis,* S. Europe; *S. lyra'ta,* N. America, slightly aromatic, and *S. polysta'chya, Chia-seed,* Mexico, are aromatic and bitter, all being used inter-

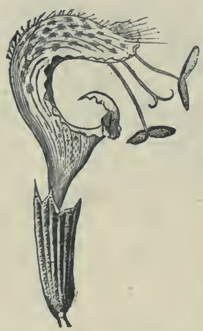


FIG. 332.—*Monarda punctata:* flower magnified.

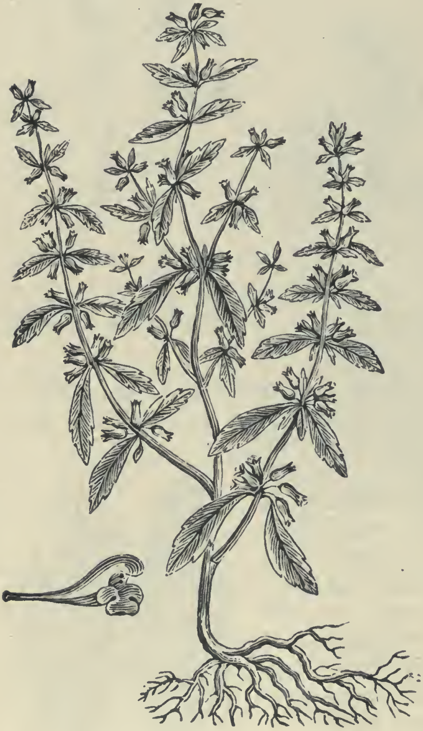


FIG. 333.—*Hedeoma pulegioides.*

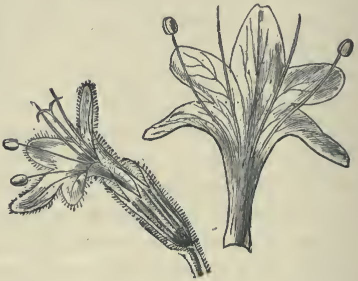


FIG. 334.—*Hedeoma pulegioides:* flower and corolla magnified.

changeably; infusions of either produce (hot) or check (cold) excessive sweating.

5. *Monar'da puncta'ta, Horse-mint.*—The leaves and tops, official 1820–1880; United States. Perennial, .6–1 M. (2–3°) high, stem branched, downy, leaves 5–7.5 Cm. (2–3′) long, lanceolate, serrate, punctate, flowers yellow, spotted red with pinkish bracts, downy, calyx 5-toothed, aromatic, pungent, bitter; contains volatile oil. Used as carminative, stimulant, emmenagogue, nervine, diaphoretic, diuretic; flatulent colic, nausea, rheumatism, neuralgia, diarrhœa; in infusion. Dose, gr. 15–60 (1–4 Gm.). *Oleum Monardæ* (volatile oil), official 1820–1880, is yellowish or reddish, sp. gr. 0.930; contains terpene, $C_{10}H_{16}$, 50 p. c., thymol (monardin), $C_{10}H_{14}O$, 25–61 p. c., also alcohol, $C_{10}H_{18}O$, and its acetic, butyric, and formic esters.

6. *Hedeo'ma pulegioi'des,* (*American*) *Pennyroyal.*—The dried leaves and flowering tops, official 1830–1910; N. America, sandy fields, hills, open woods, scenting the atmosphere. Annual herb; stem 25–37.5 Cm. (10–15′) high, quadrangular, pubescent, branched; root fibrous, yellowish. Leaves opposite, 15–35 Mm. ($\frac{3}{5}$–$1\frac{2}{5}$′) long, thin, obtuse, obscurely serrate, glandular-hairy beneath, petiolate; flowers, axillary fascicles; calyx tubular, 5-toothed, bilabiate; corolla pale blue, spotted, bilabiate, containing 2 sterile and 2 fertile stamens; odor strong, mint-like; taste aromatic, pungent; solvents: alcohol, boiling water partially; contains volatile oil 1 p. c., bitter principle, tannin. Stimulant, carminative, emmenagogue, aromatic; flatulent colic, nausea, indigestion, corrective to purgatives; hot infusion—diarrhœa, bronchitis, rheumatism, amenorrhœa (hot hip and foot baths); odor repulsive to fleas, mosquitoes, etc.; large doses, for suppressed catamenia or for inducing abortion, have occasioned death from narcosis. Dose, gr. 15–60 (1–4 Gm.); fluidextract (diluted alcohol), ʒss–2 (2–8 Ml. (Cc.)); infusion, 5 p. c., ℥ij (60 Ml. (Cc.)), every hour; spirit (oil 1, + alcohol 9), externally and in spray. Volatile oil (oleum hedeomæ), official 1830–1910, often added to liniments as a rubefacient. *Mentha Pule'gium, European Pennyroyal,* resembles closely the above, having oval, serrate leaves, and purplish flowers, cymes, corolla 4-lobed; *Hedeoma piperi'ta,* Mexico, is used for peppermint, while *H. thymoi'des,* Texas, having more agreeable odor, as aromatic, diaphoretic.

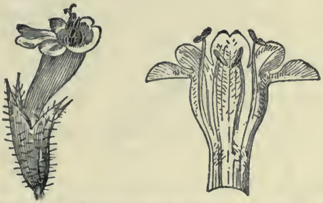


Fig. 335.—*Melissa officinalis:* flower and corolla, magnified.

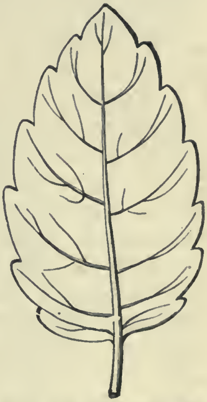


Fig. 336.—*Melissa officinalis:* leaf.

7. *Melis'sa officina'lis, Melissa, Balm.*—The leaves and tops, official 1840–1900; Asia Minor, S. Europe. Perennial herb with fragrance of lemons, growing in waste places; stems several, quadrangular, .3–1 M. (1–3°) high, branched at base, pubescent; flowers yellowish-white, purplish, calyx 5-toothed, tubular, bell-shaped; corolla bilabiate, 4 stamens. Leaves, 5 Cm. (2′) long, petiolate, ovate, obtuse, crenate, hairy, glandular, branches square; fragrant, aromatic, astringent, bitter; contains volatile oil 25 p. c., bitter principle, tannin, gum; solvents: diluted alcohol, boiling water. Carminative, diaphoretic, stimulant, antispasmodic; used as a refreshing drink; when cold for febrile affections, when hot acts slightly on the skin. Dose, gr. 15–60 (1–4 Gm.); water (aqua melissæ), leaves (1) distilled with water (10); compound spirit (spiritus melissæ compositus), balm 14 + lemon peel 12, nutmeg 6, cinnamon 3, clove 3, alcohol 150, water 250, distil 200 parts; fluidextract, ♏xv–60 (1–4 Ml. (Cc.)); infusion, ℥j–2 (30–60 Ml. (Cc.)); oil, ♏j–2 (.06–.13 Ml. (Cc.)).

8. *Hysso'pus officina'lis, Hyssop.*—S. Europe. Plant .3 M. (1°) high, stem square, leaves 2.5 Cm. (1′) long, punctate on both sides, flowers purplish-blue, stamens 4, exserted; contains volatile oil .5 p. c., bitter principle, resin, fat. Used in Biblical times as a cathartic, now as a carminative, stimulant, sudorific; for dyspepsia, amenorrhœa, rheumatism, bruises, bronchitis, sore throat, chronic catarrhs. Dose, gr. 15–60 (1–4 Gm.); infusion, 5 p. c.; oil, ♏j–2 (.06–.13 Ml. (Cc.)).

9. *Orig'anum vulga're, Wild Marjoram.*—The herb, official 1820–1860 and 1870–1890; Asia, Europe, N. Africa, naturalized in N. America. Perennial herb, .3–.5 M. (12–18′) high; stem square, purplish, downy; leaves 2.5 Cm. (1′) long, ovate, entire, pellucid-punctate, hairy beneath, flowers pale purple, calyx 5-toothed, corolla 2-lipped, 4 exserted didynamous stamens, aromatic, pungent, bitter; contains volatile oil 1 p. c., bitter principle, resin, tannin. *Oleum Origani*, official 1820–1860 and 1870–1880; consists mainly of terpene, $C_{10}H_{16}$. Used as carminative, stimulant, emmenagogue, diaphoretic, tonic, fomentation; dyspepsia, indigestion, nausea, colic, rheumatism, neuralgia; in infusion. Dose, gr. 15–60 (1–4 Gm.); oil used in liniments, carious teeth, flatulence, ♏v–10 (.3–.6 Ml. (Cc.)). The closely allied *Origanum Majora'na, Sweet Marjoram*, is cultivated largely, being used as a condiment in cooking.

MENTHA VIRIDIS. SPEARMINT.

Mentha spicata *Linné.*
(**Mentha viridis,** *Linné.*) } The dried leaves and flowering tops.

Habitat. England, wild in Europe, N. America; cultivated in the United States.

Syn. Menth. Vir., Mint, Mackerel, Lady's, Brown, Lamb or Common Garden Mint, Lammint, Sage of Bethlehem, Herba Menthæ Romanæ (Acutæ); Fr. Menthe (romaine) verte, Baume vert; Ger. Grüne Minze, Römische Minze.

Men'tha. L. fr. Gr. *μίνθη*, Minthe, a nymph, daughter of Cocytus, fabled to have been changed into a mint plant by Proserpine in a fit of jealousy (Theophrastus).

Spi-ca'ta. L. spiked—*i. e.*, the flowers.

Vir'i-dis. L. green—*i. e.*, the stem.

Spear'mint—spur + mint, from its spiry, spear-like inflorescence.

LABIATÆ

PLANT.—Perennial herb; rootstocks with elongated suckers, by which it multiplies extensively; stems .6–1.3 M. (2–4°) high, acutely quadrangular, branches opposite, smooth, often tinged with purple; flowers Aug.–Sept., spikes, calyx tubular, 5-toothed, corolla 4-lobed, light purple. LEAVES, ovate-lanceolate, 1–9 Cm. ($\frac{2}{5}$–$3\frac{3}{5}'$) long, unequally serrate, nearly sessile, or petiole only 4 Mm. ($\frac{1}{6}'$) long, bright green, somewhat glandular-hairy on under surface; more or less crumpled and mixed with large proportion of the light brown, purplish stems, occasionally with their characteristic opposite branches; stems distinctly quadrangular, 1–3 Mm. ($\frac{1}{25}$–$\frac{1}{8}'$) thick, nearly glabrous; flowers in opposite clusters, or more or less interrupted or crowded, lanceolate, nearly acute spikes; bracts linear-lanceolate, subulate, 7–10 Mm. ($\frac{1}{4}$–$\frac{2}{5}'$) long, subtending the flower clusters; calyx tubular, 5-toothed, glandular-punctate, somewhat pubescent near the teeth; corolla nearly white, light brown; stamens exserted; odor slightly pungent, characteristic; taste aromatic, characteristic, not followed by cooling sensation in the mouth; heavier, less pungent than *M. piperita.* Should be collected in dry weather, Aug.–Sept., just as flowers appear; if for oil, just after flowers have expanded. This is weaker than peppermint, being probably the cultivated form of *M. longifo'lia* (*sylves'tris*), *Horse-mint;* loses on drying 75–85 p. c. *Solvents:* alcohol; water partially. Dose, gr. 30–60 (2–4 Gm.).

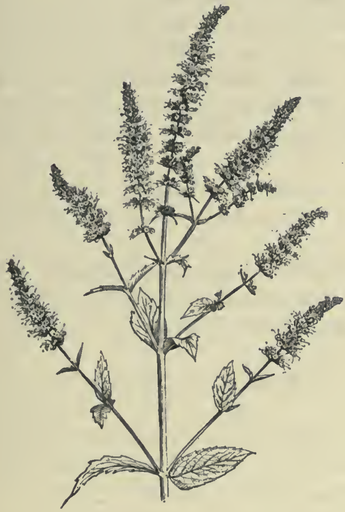


FIG. 337.—*Mentha spicata* (*viridis*): flowering tops.

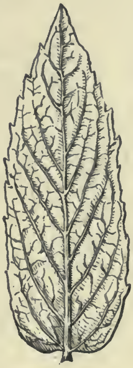


FIG. 338.—*Mentha spicata* (*viridis*): leaf, natural size.

ADULTERATIONS.—Leaves of *M. piperita*, and other species.

CONSTITUENTS.—Volatile oil .5 p. c., resin, tannin, gum.

Oleum Menthæ Viridis. Oil of Spearmint, *official.*—(Syn., Ol. Menth. Vir., Spearmint Oil; Fr. Essence de Menthe verte; Ger. Krauseminzöl, Romisch Minzöl.) This volatile oil, distilled from the flowering plant (fresh or partly dried) is a colorless, yellow, greenish-yellow liquid, characteristic odor and taste of spearmint; soluble in 80 p. c. alcohol (1) with clear solution that usually becomes cloudy on further dilution, sp. gr. 0.925, lævorotatory; contains at least 43 p. c. of carvone, $C_{10}H_{14}O$, limonene, $C_{10}H_{16}$, 43 p. c., possibly pinene, $C_{10}H_{16}$, and an unidentified alcohol, $C_{10}H_{17}OH$. It is preserved for a long time by adding 3–4 p. c. of alcohol. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

Preparations.—I. Leaves and Tops: 1. *Spiritus Menthæ Viridis.* Spirit of Spearmint. (Syn., Sp. Menth. Vir., Essence of Spearmint, Tinctura Olei Menthæ Viridis; Ger. Grüne Minzessenz.)

Manufacture: Macerate for 1 hour spearmint leaves 1 Gm. in water 50 Ml. (Cc.), strongly express; mix oil of spearmint 10 Ml. (Cc.) in alcohol 80 Ml. (Cc.), add macerated leaves, and alcohol q. s. 100 Ml. (Cc.), macerate mixture for 6 hours, frequently shaking, filter. Should be kept in amber-colored bottles. Dose, ♏x–30 (.6–2 Ml. (Cc.)).

II. Oil: 1. *Aqua Menthæ Viridis.* Spearmint Water. (Syn., Aq. Menth. Vir.; Fr. Eau de Menthe verte; Ger. Römisch Minzwasser.)

Manufacture: $\frac{1}{5}$ p. c. Similar to Aquæ Aromaticæ; triturate oil .2 Ml. (Cc.) with purified talc 1.5 Gm., recently boiled distilled water q. s. 100 Ml. (Cc.), filter until clear. Dose, ℥ss–1 (15–30 Ml. (Cc.)).

2. *Spiritus Menthæ Viridis.* Spirit of Spearmint, 10 p. c. Dose, ♏x–30 (.6–2 Ml. (Cc.)). See above.

Unoff. Preps.: I. Leaves and Tops: *Infusion,* 5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)). *Fluidextract,* dose, ʒj–2 (4–8 Ml. (Cc.)). II. Leaves and Tops, or Oil: *Syrup,* dose, ʒj–4 (4–15 Ml. (Cc.)).

Properties.—Carminative, stimulant, nervine; flavoring.

Uses.—Same as peppermint, but as it is much milder it is to be preferred in disorders of infancy, culinary purposes, confectionery, perfumery.

Allied Plants:

1. *Mentha cris'pa, Crisped-leaved, Cross* or *Curled Mint.*—This is the cultivated form of *M. spicata* (*viridis*), known also as *M. aquat'ica* var. *crispa,* leaves pubescent, cordate pointed, crisped; *M. sati'va, M. arven'sis,* and *M. rotundifo'lia,* are under cultivation and sometimes produce similar crisped leaves.

2. *Ly'copus virgin'icus, Bugle Weed.*—The herb, official 1830–1880; N. America. Plant has smooth, obtusely quadrangular stem, 15–60 Cm. (6–24′) high; leaves 5 Cm. (2′) long, elliptic, glandular; flowers purple, 4-lobed, stamens 2, mint odor and bitter taste, root perennial, creeping; contains volatile oil, resin, bitter principle, tannin. Used as astringent, tonic, sedative, narcotic; hemorrhage, diarrhœa, dysentery; in infusion, decoction. Dose, gr. 5–30 (.3–2 Gm.).

LABIATÆ

MENTHA PIPERITA. PEPPERMINT.

Mentha piperita, *Linné.* } The dried leaves and flowering tops.

Habitat. Asia, Europe, N. America; wild in low ground, wet places; cultivated in Japan, Germany, England, Michigan, New York, etc.

Syn. Menth. Pip., Brandy (Lamb) Mint, Lammint, Herba Menthæ Piperitæ; Fr. Menthe poivrée; Ger. Folia Menthæ piperitæ, Pfefferminzblätter.

Pi-pe-ri′ta. L. *piper, pepper*—peppery-mint—*i. e.*, from its aromatic burning taste.

Pep′permint—pepper + *mint—i. e.*, mint with pepper properties.

Plant.—Perennial herb, possibly from *M. hirsu′ta, Water Mint,* by cultivation; rootstock creeping, producing long suckers by which it multiplies; stem square, purplish, .6–1.3 M. 2–4°) high. Leaves, ovate-oblong, 1–9 Cm. ($\frac{2}{5}$–3$\frac{3}{5}$′) long, petiole 4–15 Mm. ($\frac{1}{6}$–$\frac{3}{5}$′) long, pubescent, acute, sharply serrate, light green, purplish-brown, upper surface nearly glabrous, lower surface glandular, hairy, especially on veins; more or less crumpled and frequently detached from stems, which are quadrangular, 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, glabrous except for a few scattered deflexed hairs; flower-whorls in oblong (oval) spikes which are usually compact, or somewhat interrupted at base, 1–1.5 Cm. ($\frac{2}{5}$–$\frac{3}{5}$′) broad, rounded at summit, and in fruit 3–7 Cm. (1$\frac{1}{5}$–2$\frac{4}{5}$′) long; bracts oblong-lanceolate, very acuminate, 7 Mm. ($\frac{1}{3}$′) long, calyx tubular, equally 5-toothed, pubescent, glandular-punctate, often dark purplish; corolla tubular-campanulate, 4-cleft, 3 Mm. ($\frac{1}{8}$′) long, often light purple; stamens 4, short; nutlets ellipsoidal, .5 Mm. ($\frac{1}{50}$′) thick, blackish-brown; odor aromatic, characteristic; taste aromatic, pungent, followed by cooling sensation in the mouth. Powder, greenish; microscopically—fragments with subglobular, shortly and stoutly stalked oil-glands, hairs having menthol crystals in one or more of the cells. Should be collected in dry weather, Aug.–Sept., when in bloom; strongest and most pungent of all mints. *Solvents:* alcohol; water partially. Dose, gr. 15–60 (1–4 Gm.).

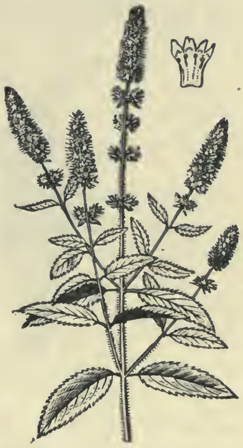


Fig. 339.—*Mentha piperita:* flowering tops.

Adulterations.—Leaves chiefly of varieties of this species: (*a*) var. *officina′lis*—leaves narrower, spikes longer; (*b*) var. *vulga′ris*—leaves broader, base more rounded, spikes more blunt and close; spearmint leaves, which may readily be distinguished from peppermint which has leaves with petioles, inflorescence thicker and more crowded, flowers larger with shorter calyx-teeth, and its own distinctive odor and taste.

Commercial.—English is regarded best, Japanese is consumed chiefly for obtaining menthol (50–80 p. c.), while the United States produces most.

Constituents.—Volatile oil 1 p. c. (menthol), resin, tannin, gum, chlorophyll.

Oleum Menthæ Piperitæ. Oil of Peppermint, *official.*—(Syn., Ol. Menth. Pip., Peppermint Oil; Fr. Essence de Menthe poivrée; Ger. Pfefferminzöl.) This volatile oil, distilled from the flowering plant (fresh or partly dried) and rectified by steam distillation, is a colorless liquid, strong odor of peppermint, pungent taste, followed by a sensation of cold upon drawing air into the mouth; soluble in 4 vols. of 70 p. c. alcohol, showing not more than slight opalescence and no separation of oil globules, sp. gr. 0.902, lævorotatory; contains 16 constituents: at least 5 p. c. of esters, calculated as menthyl acetate, $C_{10}H_{19}C_2H_3O_2$, and 50 p. c. of total menthol, free and as esters; also acetic and isovaleric acids, acetaldehyde, isovaleric aldehyde, amyl alcohol, pinene, phellandrene, limonene, $C_{10}H_{16}$, menthone, $C_{10}H_{18}O$, menthyl isovalerate, menthyl ester, cadinene, $C_{15}H_{24}$, a lactone, dimethyl sulphide; the hydrocarbons holding menthol dissolved are mainly the several terpenes (English—pinene, phellandrene, sesquiterpene; Japanese—sesquiterpene alone) with carvene odor, the higher boiling ones, $C_{15}H_{24}$, having less pleasant odor; menthol and its esters (first 2 constituents) are most important, the others occurring in small quantities, being objectionable for flavoring and removed by rectification with steam. *Tests:* 1. Distil oil 25 Ml. (Cc.), collect the first 1 Ml. (Cc.) and pour it on 5 Ml. (Cc.) of mercuric chloride T. S.—no white film at zone of contact in 1 minute (abs. of dimethyl sulphide, found in non-rectified oils). Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

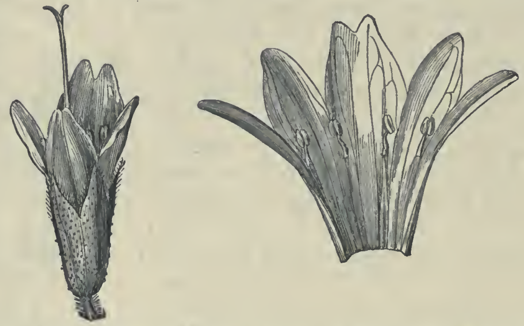


Fig. 340.—*Mentha piperita:* flower and corolla cut open; magnified 8 diam.

Adulterations.—Oil of erigeron, castor oil, oil of turpentine, oil of copaiba, oil of camphor, oil of sassafras, alcohol; the first, second, and third prevent its solubility in equal volume of alcohol (80 p. c.); the fourth gives buttery mass with sulphuric acid; oils of turpentine, camphor, and sassafras each render its action with iodine more violent, the two latter being red with nitric acid; dementholized oil (lower sp. gr.).

Menthol. Menthol, $C_{10}H_{19}OH$, *official.*—(Syn., Pipmenthol, Peppermint Camphor; Fr. Alcool Mentholique, Menthol Gauche, Camphre de Menthe; Ger. Mentholum, Pfefferminzkampfer, Mentha-kampfer.)

This is a secondary alcohol (stearoptene), obtained from oil of peppermint or other mint oils (Japanese and Chinese oil of peppermint—*M. arven'sis* var. *piperas'cens*, *M. canaden'sis* var. *glabra'ta*). It is obtained by subjecting the volatile oil simply to refrigeration at —22.2° C. (—8° F.), by means of ice and salt; when solidified the temperature is allowed to rise gradually, the liquid portion poured off from time to time, and the crystals deprived of oil by expression; may purify by recrystallization. It is in colorless, acicular or prismatic crystals, strong odor and taste of peppermint, with a sensation of warmth followed by cold upon drawing air into the mouth; soluble in alcohol, chloroform, ether, petroleum benzin, liquid petrolatum, fixed or volatile oils, slightly in water; alcoholic solution neutral, lævorotatory; melts at 43° C. (110° F.); triturated with an equal weight of either camphor, phenol, thymol, or hydrated chloral—mixture becomes liquid; distilled with P_2O_5 yields menthene, $C_{10}H_{18}$, a colorless liquid of pleasant odor. *Tests:* 1. Heat 2 Gm. in open dish—gradually volatilizes with residue .05 Gm. (abs. of wax, paraffin, organic substances). 2. Few crystals dissolved in glacial acetic acid 1 Ml. (Cc.), + sulphuric acid 3 drops and nitric acid 1 drop—not green (abs. of thymol). *Impurities:* Wax, paraffin, thymol, magnesium sulphate, inorganic substances. Should be kept cool, in well-closed containers. Dose, gr. 1–2 (.06–.13 Gm.).

Preparations.—I. Leaves and Tops: 1. *Spiritus Menthæ Piperitæ.* Spirit. of Peppermint. (Syn., Sp. Menth. Pip., Essence of Peppermint; Fr. Alcoolat (Essence) de Menthe poivrée; Ger. (Englische) Pfefferminz (-essenz)-spiritus.)

Manufacture: Macerate for 1 hour peppermint leaves 1 Gm. in 50 Ml. (Cc.) of water, strongly express; mix oil of peppermint 10 Ml. (Cc.) in alcohol 80 Ml. (Cc.), add macerated leaves, and alcohol q. s. 100 Ml. (Cc.), macerate mixture for 6 hours, frequently shaking, filter. Should be kept in amber-colored bottles. Dose, ♏x–30 (.6–2 Ml. (Cc.)).

II. Oil: 1. *Aqua Menthæ Piperitæ.* Peppermint Water. (Syn., Aq. Menth. Pip.; Fr. Eau de Menthe poivrée; Ger. Pfefferminzwasser.)

Manufacture: $\frac{1}{5}$ p. c. Similar to Aquæ Aromaticæ; triturate oil .2 Ml. (Cc.) with purified talc 1.5 Gm., recently boiled distilled water q. s. 100 Ml. (Cc.), filter until clear. Dose, ℥ss–1 (15–30 Ml. (Cc.)).

2. *Spiritus Menthæ Piperitæ.* Spirit of Peppermint, 10 p. c. Dose, ♏x–30 (.6–2 Ml. (Cc.)). See above.

3. *Pilulæ Rhei Compositæ,* ♏ $\frac{1}{13}$ (.005 Ml. (Cc.)) in each pill.

Unoff. Preps.: Leaves and Tops: *Fluidextract,* dose, ʒj–2 (4–8 Ml. (Cc.)). *Infusion,* 5 p. c., dose ℥j–2 (30–60 Ml. (Cc.)). *Syrup,* dose, ʒj–4 (4–15 Ml. (Cc.)). *Troche* (each contains oil ♏ $\frac{1}{7}$; .009 Ml. (Cc.)). Menthol: *Camphorated,* menthol and camphor each 47.5, alcohol 5. *Inunction,* 5 p. c., + hydrous wool fat 95. *Compound Inunction,* 5 p. c., + methyl salicylate 10, hydrous wool fat 85. *Petroxolin,* 17 p. c., + liquid petroxolin 83. *Spray* (*Nebula*), 2 p. c., + light liquid petrolatum q. s. 100. *Compound Spray,* 1 p. c., + camphor 1, methyl salicylate .5, eucalyptol .2, oil of cinnamon .2, light liquid petrolatum q. s. 100. *Emplastrum Menthol* (Br.), 15 p. c., + yellow wax 10, rosin 75.

Properties.—Carminative, stimulant, nervine, antispasmodic.

Uses.—Spasmodic stomach and bowel pains, flatulency, nausea, cholera morbus, diarrhœa, dysentery, colic, dysmenorrhœa, nervous headache, hiccough, heart palpitation, vomiting, as a flavoring agent; externally the oil and menthol for rheumatism, neuralgia, toothache, antibacterial.

LAVANDULA. LAVENDER.

Oleum Lavandulæ. Oil of Lavender, *official.*

Lavandula vera, *De Candolle.* } A volatile oil distilled from the fresh flowering tops.

Habitat. S. Europe (France, Italy, Spain), N. W. Africa—sunny hills and mountains; cultivated.

Syn. True (Garden, Spike, Common) Lavender, Flores Lavandulæ; Fr. Lavande Vraie,—officinale; Ger. Lavendelblüthen; Ol. Lavand., Oleum Lavandulæ Florum, U. S. P. 1900; Fr. Essence de Lavande; Ger. Lavendelöl.

La-van'du-la. L. fr. *lavo, lavare,* to wash—*i. e.,* medieval name, in allusion to the use made of its distilled water for bathing.

Ve'ra. L. *verus,* true, real—*i. e.,* the genuine and preferred kind.

Plant.—Shrub .3–1 M. (1–3°) high; stem crooked, branched, bark brownish-gray, much cleft when old; leaves linear, sessile, entire, revolute margins, with whitish down, crowded at bases of the quadrangular branches; flowers June–July, lilac-color, terminal spikes, 2-lipped, hairy, glandular; entire plant delightfully fragrant.

Constituents.—Volatile oil 1–3 p. c., resin, tannin.

Oleum Lavandulæ. Oil of Lavender.—A colorless, yellow liquid, characteristic odor and taste of lavender flowers, soluble in 3 vols. of 70 p. c. alcohol, sp. gr. 0.880, lævorotatory; contains a terpene, $C_{10}H_{16}$, 2 alcohols—geraniol, $C_{10}H_{18}O$, and (chiefly) linalool, $C_{10}H_{18}O$, also its compound ether—linaloyl acetate, $C_{10}H_{17}C_2H_3O_2$, 30–36 p. c., upon which the value depends, and a little cineol; the presence of this latter in considerable quantity proves the adulteration with oil of spike lavender. When cold deposits stearoptene, and if distilled from leaves and stalks the odor is more rank. *Tests:* 1. Shake in a narrow glass cylinder with equal volume of distilled water—volume not diminished (abs. of alcohol). The *French* oil is from flowers, sometimes including leaves, of wild plants collected July–Sept., the late and high altitude products being best—chief commercial article; the *English* oil (oil of garden lavender) is solely from flowers of cultivated plants, the yield being small and price high. Should be kept cool, dark, in well-stoppered amber-colored bottles. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

Adulterations.—Oil of turpentine—less soluble in alcohol; oil of spike lavender—greener, more terebinthinate, camphoraceous odor, with more terpene and cineol; oil of sweet basil (*Oc'ium Basil'icum*), Asia, Africa—plant cultivated in gardens for seasoning food and for its white or reddish flowers; oil balsamic, aromatic, possessing a cooling taste.

PREPARATIONS.—1. *Spiritus Lavandulæ.* Spirit of Lavender. (Syn., Sp. Lavand.; Fr. Alcoolat (Esprit, Eau) de Lavande; Ger. Lavendelspiritus.)

Manufacture: 5 p. c. Dissolve oil 5 Ml. (Cc.) in alcohol q. s. 100 Ml. (Cc.). Dose, ʒss–1 (2–4 Ml. (Cc.)).

2. *Tinctura Lavandulæ Composita.* Compound Tincture of Lavender. (Syn., Tr. Lavand. Co., Compound Spirit of Lavender, Lavender Drops; Fr. Teinture de Lavande composée; Ger. Zusammengesetzte Lavendeltinktur.)

Manufacture: $\frac{4}{5}$ p. c. Similar to Tinctura Aloes, page 110—using oil of lavender .8 Ml. (Cc.), oil of rosemary .2 Ml. (Cc.), saigon cinnamon 2 Gm., clove .5 Gm., myristica 1 Gm., red saunders 1 Gm., macerating powders in alcohol 75 Ml. (Cc.), in which the oils have been dissolved, and water 25 Ml. (Cc.), finishing with 75 p. c. alcohol. Dose, ʒss–1 (2–4 Ml. (Cc.)).

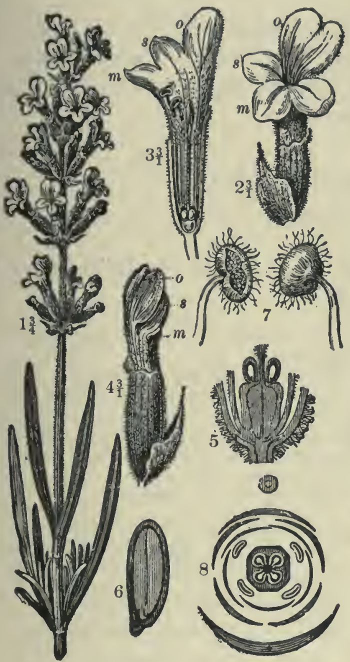


FIG. 341.—*Lavandula vera: 1,* flowering twig; *2,* flower with sepal; *3,* longitudinal section of flower; *4,* flower bud; *5,* vertical section of flower bud with ovary; *6,* vertical section of little nut; *7,* stamens; *8,* diagram of flower.

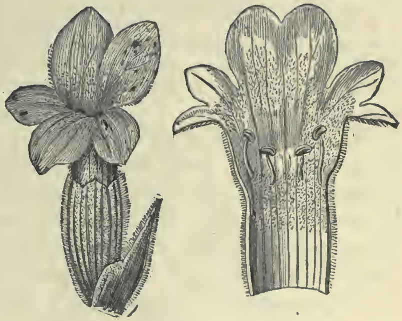


FIG. 342.—Lavender flower and corolla: magnified 4 diam.

Prep.: 1. *Liquor Potassii Arsenitis,* 3 p. c. (arsenic trioxide 1 p. c., potassium bicarbonate 2 p. c.).

3. *Linimentum Saponis Mollis,* 2 p. c. 4. *Spiritus Ammoniæ Aromaticus,* $\frac{1}{10}$ p. c. 5. *Unguentum Diachylon,* 1 p. c.

Unoff. Preps.: Water (Aqua). Of flowers may have *Infusion* and *Fomentation.*

PROPERTIES.—Stimulant, carminative, nervine, errhine.

USES.—Gastralgia, nausea, flatulence, to correct nauseating medicines, nervous headache; mostly in perfumery.

Flowers, official 1840–1890. *Oleum Lavandulæ,* official 1880–1890; distilled from the entire fresh flowering plant.

Allied Plants:

1. *Lavandula spi'ca, Spike Lavender, Male Lavender.*—The flowers, official 1820–1840; S. France; cultivated. Plant .3–.5 M. (12–18′) high, branching from base; leaves broad, oblanceolate, sessile, revolute at the edge, with whitish down; flowers July, villous, lilac-color. *L. Stœ'chas, Arabian* or *French Lavender.* Flowers dark purple, odor aromatic, camphoraceous, and with other varieties used for obtaining the oil.

2. *Collinso'nia canaden'sis, Stone-root, Horse-balm.*—N. America. Rhizome 10 Cm. (4′) long, branches short, knotty, white inside, inodorous, taste bitter, nauseous; contains volatile oil, resin. Diaphoretic, diuretic, tonic, astringent, irritant.

ROSMARINUS. ROSEMARY.

Oleum Rosmarini. Oil of Rosemary, *official.*

Rosmarinus officinalis, *Linné.*	A volatile oil distilled from the fresh flowering tops.

Habitat. Mediterranean Basin—Spain to Asia Minor, N. Africa, reaching to Madeira and the Canary Islands; cultivated in gardens.

Syn. Garden Rosemary, Old-man, Folia Rosmarini, Folia Roris Marini, Folia Anthos; Fr. Romarin; Ger. Rosmarin, Meerthau; Ol. Rosmar., Rosemary Oil, Oleum Anthos; Fr. Essence de Romarin; Ger. Rosmarinöl.

Ros-ma-ri'nus. L. *ros,* dew, mist, + *marinus, maris,* of the sea—sea foam—*i. e.,* from its maritime habitat and glaucous appearance. *Rosemary*—not Mary's rose.

Of-fi-ci-na'lis. L. see etymology of (*Asagrœa*) *officinalis,* page 102.

Plant.—Small perennial shrub 1–1.3 M. (3–4°) high, bushy, much branched; bark pale brown, twigs tomentose; flowers April–May, bilabiate, upper lip 2-parted, lower 3-divided, middle one being the largest, pale blue; fruit achenes, subglobose, smooth; leaves evergreen, many, sessile, 2.5 Cm. (1′) long, linear, both ends blunt, entire, margins revolute, dark green, shining above, woolly with white, stellate hairs beneath, like the flowers, with aromatic fragrance, camphor-like; taste bitter.

Constituents.—Volatile oil 1 p. c., resin, tannin, bitter principle.

Oleum Rosmarini. Oil of Rosemary.—This volatile oil, obtained by distilling the fresh flowering tops with water or steam, is a colorless, pale yellow liquid, characteristic odor of rosemary, camphoraceous taste, soluble in 10 vols. of 80 p. c. alcohol, sp. gr. 0.903, dextrorotatory; contains pinene, $C_{10}H_{16}$, 80 p. c., camphene, cineol, $C_{10}H_{18}O$, camphor, $C_{10}H_{18}$, also at least 2.5 p. c. of ester, calculated as bornyl acetate, $C_{10}H_{17}C_2H_3O_2$, and 10 p. c. of total borneol, $C_{10}H_{17}OH$. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

Adulterations.—Oil: Oil of turpentine, etc., recognized by odor and not being affected by an equal volume of alcohol, which dissolves out oil of rosemary.

Commercial.—The Dalmatian (Italian) oil of rosemary, distilled after the flowering season is over, and the French, distilled from the flowering tops and of finer odor, are the chief commercial varieties, the English, from cultivated plants, and the Spanish being high priced, greatly esteemed by some, but little used.

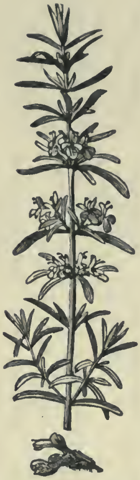


Fig. 343.—*Rosmarinus officinalis:* branch and flowers.

Preparations.—1. *Linimentum Saponis,* 1 p. c. 2. *Tinctura Lavandulæ Composita,* $\frac{1}{5}$ p. c.

Unoff. Prep.: Spiritus Rosmarini (Br.), oil 10 p. c.

Properties.—Carminative, stimulant, diuretic, diaphoretic, emmenagogue; excessive doses cause death.

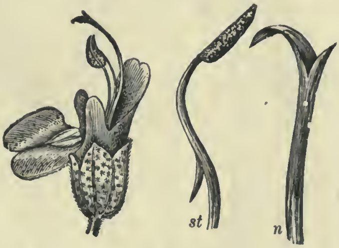


Fig. 344.—*Rosmarinus officinalis: st,* stamen with anther; *n,* style with stigma.

Uses.—Colic, nervous disorders, menstrual derangements; externally in rheumatism, sprains, bruises. Stimulates the hair in alopecia, reduces temperature, and imparts violet odor to urine; mainly used in liniments, lotions, ointments, perfumery.

Tops or Leaves, official 1820–1890.

RECAPITULATION No. 6.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
Umbelliferæ:								
1. Sumbul. 2. Sumbul.	Ferula Sumbul.	The rhizome and roots.	C. and N. W. Asia.	Volatile oil, resin, angelic acid, valeric acid.	Extract, fluidextract.	Stimulant, tonic, nervine, antispasmodic.	Hysteria, epilepsy, chlorosis, amenorrhœa, delirium tremens.	10–30 (.6–2 Gm.).
Ericaceæ:								
1. Methylis Salicylas. 2. Methyl Salicylate.	Gaultheria procumbens. Betula lenta.	An ester (compd. ether).	N. America.	$CH_3C_7H_5O_3$.	Emul. ol. morrh., fldext. cas. sag. ar., syr. sars. co.	Antiseptic, analgesic, carminative, stimulant, flavoring.	Rheumatism, migraine, sciatica, lumbago.	Minims. 1–10 (.06–.6 Ml. (Cc.)).
1. Uva Ursi. 2. Uva Ursi.	Arctostaphylos Uva-ursi.	The dried leaves.	Europe, Asia, N. America.	Tannin, gallic acid, arbutin, ericolin, urson.	Fluidextract.	Astringent, diuretic, tonic, nephritic.	Cystitis, gravel, gleet, menorrhagia, bronchitis, diarrhœa.	Grains. 15–60 (1–4 Gm.).
Styracaceæ:								
1. Benzoinum. 2. Benzoin.	Styrax Benzoin, +.	The balsamic resin.	Sumatra, Java, Borneo, Siam.	Benzoic and cinnamic acids, resin, volatile oil, vanillin.	Benzoinated lard, tinct., tinct. benz. co., benzoic acid.	Stimulant, expectorant, antiseptic, diuretic.	Laryngitis, diarrhœa, wounds, coryza, ulcers.	5–30 (.3–2 Gm.).
Oleaceæ:								
1. Oleum Olivæ. 2. Olive Oil.	Olea europæa.	The fixed oil.	Asia, S. Europe.	Olein, linolein, palmitin, arachin, phytosterin.	Lead plast., soap: lin., ext. colocy. co., pil. aloes, pil. asaf.	Nutrient, laxative, demulcent, protective.	Constipation of infants, gallstones, bruises, sprains, wounds, ascarides, lubrication.	Minims. 60–480 4–30 Ml. (Cc.)).
1. Manna. 2. Manna.	Fraxinus Ornus.	The dried saccharine exudation.	Mediterranean Basin.	Mannite, glucose, resin, fraxin, mucilage.	Infusum sennæ comp.	Laxative, demulcent, expectorant, cholagogue.	Piles, urinary irritation, to evacuate bowels of children, etc.	Grains. 60–480 (4–30 Gm.).
Loganiaceæ:								
1. Gelsemium. 2. Gelsemium.	Gelsemium sempervirens.	The dried rhizome and roots.	S. United States.	Volatile oil, gelsemine, gelseminine, gelsemic acid, resin, starch.	Extract, fluidextract, tincture.	Nervine, sedative, antispasmodic, antiperiodic.	Rheumatism, neuralgia, intermittents, dysmenorrhœa, chorea, hysteria, epilepsy, tetanus.	2–10 (.13–6 Gm.).
1. Spigelia. 2. Spigelia.	Spigelia marylandica.	The dried rhizome and roots.	United States.	Volatile oil, resins, bitter principle, spigeline, tannin, fat.	Fluidextract.	Anthelmintic, toxic, mydriatic.	Round worms.	30–120 (2–8 Gm.).
1. Nux Vomica. 2. Nux Vomica.	Strychnos Nux-vomica.	The dried ripe seeds.	India, E. India Islands.	Strychnine, brucine, igasurine, igasuric acid, loganin, fat.	Extract, fluidextract, tincture, strychnine: nitrate, sulphate.	Spinal nervine, tonic, poisonous.	Atonic dyspep., nervousness, anæmia, paralysis, lead palsy, tetanus, chorea, epilepsy.	½–5 (.03–.3 Gm.).
Gentianaceæ:								
1. Gentiana. 2. Gentian.	Gentiana lutea.	The dried rhizome and roots.	C. and S. Europe.	Gentiopicrin, gentiin, gentiogenin, gentienin, gentianose, fixed oil, pectin, resin.	Extract, fluidext., tinct. gent. comp.	Tonic, bitter.	Increases digestion, amenorrhœa, dyspepsia, intermittents.	5–30 (.3–2 Gm.).

Apocynaceæ:							
1. Strophanthus. 2. Strophanthus.	Strophanthus: Kombé, hispidus.	The dried ripe seeds.	Africa, Asia.	Strophanthin, choline, trigonelline, kombic acid, fixed oil.	Tincture.	Heart stimulant, diuretic.	Bright's disease, heart palpitation, endocarditis, asthma, dropsy.	⅛–½ (.008–.03 Gm.).
1. Aspidosperma. 2. Aspidosperma.	Aspidosperma Quebracho-blanco.	The dried bark.	S. America, Argentine Rep., Chile.	Aspidospermine, aspidospermatine, aspidosamine, quebrachine, tannin.	Fluidextract.	Cardiac and respiratory stimulant, antispasmodic.	Dyspnœa, phthisis, asthma, to endure fatigue.	15–30 (1–2 Gm.).
Convolvulaceæ:							
1. Jalapa. 2. Jalap.	Exogonium purga.	The dried tuberous root.	E. Mexico.	Resin (jalapin and jalapurgin), starch, gum.	Comp. powder, resin, comp. cath. pills.	Hydragogue cathartic, diuretic.	Constipation, dropsy, fevers, inflammations, head affections.	5–20 (.3–1.3 Gm.).
1. Scammoniæ Radix. 2. Scammony Root.	Convolvulus Scammonia.	The dried root.	W. Asia.	Resin, gum, tannin, starch.	Resin, extr. colocynth. comp.	Hydragogue, cholagogue cathartic.	Dropsies, cerebral affections, torpid intestines.	5–20 (.3–1.3 Gm.).
Hydrophyllaceæ:							
1. Eriodictyon. 2. Eriodictyon.	Eriodictyon californicum.	The dried leaves.	California.	Volatile oil, resin, eriodictyol, triacontane, tannin.	Fluidextract.	Expectorant, bitter tonic, stimulant.	Bronchitis, asthma, to disguise quinine taste.	30–60 (2–4 Gm.).
Labiatæ:							
1. Oleum Thymi. 2. Oil of Thyme.	Thymus vulgaris.	The volatile oil.	S. Europe.	Phenols, cymene, thymene, thymol, pinene, borneol.	Thymol.	Stimulant, tonic, emmenagogue, antispasmodic, antiseptic.	Chlorosis, rheumatism, neuralgia, bronchitis, diarrhœa, gleet, vesical catarrh.	Minims. 1–5 (.06–.3 Ml. (Cc.)).
1. Mentha Viridis. 2. Spearmint.	Mentha spicata (viridis).	The dried leaves and tops.	Europe, N. America.	Volatile oil, resin, tannin, gum.	Spirit, *Oil:* water, spirit.	Carminative, stimulant, nervine.	Cholera infantum, culinary and confectionery purposes, perfume.	Grains. 30–60 (2–4 Gm.).
1. Mentha Piperita. 2. Peppermint.	Mentha piperita.	The dried leaves and tops.	Asia, Europe, N. America.	Volatile oil, resin, tannin, gum.	Spirit, *Oil:* water, spirit, pil. rhei comp., menthol.	Carminative, stimulant, nervine, antispasmodic.	Flatulence, colic, nausea, diarrhœa, headache, dysmenorrhœa, rheumatism, toothache.	15–60 (1–4 Gm.).
1. Oleum Lavandulæ. 2. Oil of Lavender.	Lavandula officinalis.	The volatile oil.	S. Europe.	Terpene, $C_{10}H_{16}$, geraniol, linalool, $C_{10}H_{18}O$.	Spirit, comp. tinct., Fowler's solution, lin. sap., sp. am. aro., oint. diachy.	Stimulant, carminative, nervine, errhine.	Gastralgia, nausea, headache, flatulence, perfumery.	Minims. 1–5 (.06–.3 Ml. (Cc.)).
1. Oleum Rosmarini. 2. Oil of Rosemary.	Rosmarinus officinalis.	The volatile oil.	S. Europe, Med. Basin.	Pinene, camphor borneol, cineol.	Soap liniment, tinct. lavender comp.	Carminative, stimulant, diuretic, diaphoretic.	Colic, nervousness, menstrual derangements, rheumatism, sprains.	1–5 (.06–.3 Ml. (Cc.)).

63. SOLANACEÆ. Nightshade (Potato) Family.

Sol-a-na′se-e. L. *Solan-um* + aceæ, fr. *sol*, the sun—*i. e.*, plants dislike sunlight, grow best in the shade, hence nightshade; or *solor*, to comfort—*i. e.*, the plants, soothing, narcotic effect; or *sulanum, sus*, hog—*i. e.*, plants act as cure for swine disease. Herbs, rarely shrubs, trees. Distinguished by having colorless juice, mydriatic alkaloids, alternate leaves; flowers regular, 5's, isomerous, plicate border; ovary superior, 2-celled, ovules many, embryo straight or coiled in fleshy albumin; fruit, capsule or berry, some edible. Differs from Convolvulaceæ by not twining and in having many seeds; universal, tropics; narcotic, stimulant, bitter, tonic, poisonous.

Genera: **1. Capsicum. 2. Atropa. 3. Hyoscyamus. 4. Datura.**

CAPSICUM. CAPSICUM.

Capsicum frutescens, *Linné.* { The dried fruits, with not more than 2 p. c. of stems, calyxes, other foreign matter.

Habitat. S. and C. America (Cayenne in Guiana), introduced into E. Indies, Java (by Portuguese), also into Africa; cultivated in United States, also in tropics.

Syn. Capsic., Cayenne Pepper, African Chillies, Spanish, Red, Bird, Garden, Cockspur, Pod, Chilly, Zanzibar, Goat's, Guinea, American Cayenne or African Cayenne Pepper, Chillies; Piper Hispanicum; Br. Capsici Fructus; Fr. Capsique, Piment (rouge) des jardins, Poivre de Cayenne-, Guinée or d'Inde; Ger. Fructus Capsici, Spanischer Pfeffer, Schlotenpfeffer.

Cap′si-cum. L. *capsa*, a box—*i. e.*, shape of the fruit; or from Gr. *κάπτω*, to bite—*i. e.*, from its hot, pungent properties.

Fru-tes′cens. L. *frutex*, shrub, bush—*i. e.*, somewhat shrub-like in habit and appearance.

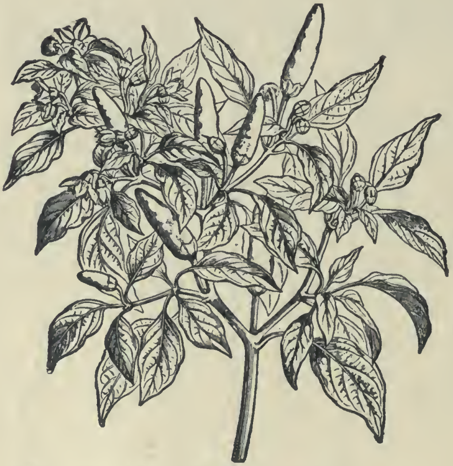


FIG. 345.—*Capsicum frutescens.*

PLANT.—Small, spreading shrub, .6–1 M. (2–3°) high; stem much branched; leaves alternate, 5–7.5 Cm. (2–3′) long, entire, glabrous; flowers 2–3 together in the bifurcations, greenish-yellow, July–Aug.; ovary 2-celled, many ovules. FRUIT, oblong-conical, 8–20 Mm. ($\frac{1}{3}$–$\frac{4}{5}$′)

long, 2–15 Mm. ($\frac{1}{12}$–$\frac{3}{5}'$) thick, brownish-red, orange (pericarp), shining, membranous, translucent; 2–3-locular, united below, containing 6–17 flat, reniform, yellowish seeds attached to placenta, frequently detached; odor characteristic, sternutatory; taste intensely pungent; calyx when present light greenish-brown, inferior, inconspicuous, 5-toothed, usually attached to long straight peduncle. POWDER, yellowish-brown; microscopically—mounts with hydrated chloral T. S. (under microscope) show yellowish-red oil globules; stone cells 2 kinds, elongated, uniformly thin-walled (endocarp), irregular, thick-walled (seed-coat); non-volatile extractive, soluble in ether, 15 p. c. *Solvents:* alcohol; ether; hot water partially. Dose, gr. 1–5 (.06–.3 Gm.).

ADULTERATIONS.—FRUIT: Fruits of allied species; POWDER: Red lead oxide, colored sawdust, bran, etc.—the former recognized by adding diluted nitric acid to dissolve lead and precipitating same with sodium sulphate—the two latter by the microscope; corn meal, starch (iodine test), ash 15–18.4 p. c.

Commercial.—Plant largely cultivated in our country to supply demand. Fruit is plucked, exposed to sun until dried, then packed in suitable shape for market; much imported from India, Africa—Liberia, Zanzibar, Natal, Bombay, Penang, Pegu, Cayenne, etc.

CONSTITUENTS.—Capsaicin (capsacutin, capsicin) .02 p. c., Capsicine, Volatile oil, fixed oil, fat acids (oleic, stearic, palmitic), resin, red coloring matter (cholesterin ester of the fatty acids), ash 7 p. c., of which 1 p. c. is insoluble in hydrochloric acid.

Capsaicin, $C_{18}H_{28}NO_3$.—Considered the chief active constituent—identical with capsacutin, resides mostly in the pericarp and placenta, and is obtained by adding diluted caustic alkali to the petroleum extract, passing CO_2 through this alkaline solution, when it crystallizes out in colorless form. It is soluble in alcohol, ether, benzene, fixed oils, and its vapors are intensely acrid and irritating. It has also been obtained as an oleoresin (capsicin, capsicol), amorphous resin-like acid, to which the red coloring matter persistently adheres. Dose, gr. $\frac{1}{10}$–$\frac{1}{4}$ (.006–.016 Gm.).

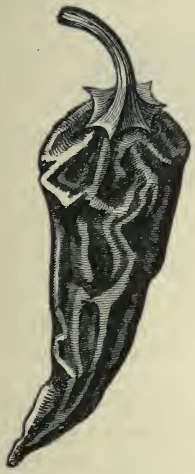


FIG. 346. — Capsicum fruit: magnified.

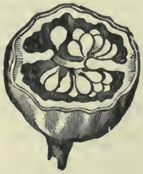


FIG. 347. — Capsicum fruit: cross-section, magnified.

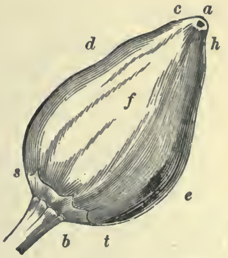


FIG. 348. — *Capsicum annuum:* fresh fruit one-half natural size.

Capsicine.—This occurs in small quantity; it is a volatile alkaloid, having odor of coniine—devoid of pungency—and is an oily liquid, not existing in the unripe fruit, but results from decomposition processes in ripening.

Volatile Oil.—Obtained by distillation and gives to the fruit its odor.

PREPARATIONS.—1. *Oleoresina Capsici.* Oleoresin of Capsicum. (Syn., Oleores. Capsic.; Fr. Oleoresine (Extrait éthéré) de Capsique; Ger. Spanisch-pfeffer-oelharz.)

Manufacture: Percolate slowly, in a covered glass percolator, 100 Gm. with ether, added in successive portions, until 160 Ml. (Cc.) of percolate obtained, reclaim most of the ether on water-bath, transfer residue to a dish, allow remaining ether to evaporate spontaneously in a warm place, pour off liquid portion, transfer remainder to a glass funnel with pledget of cotton; when separated fatty matter (which is to be rejected) has drained, mix liquid portions; yield 12–15 p. c. Should be kept in well-stoppered bottles. Dose, ♏¼–1 (.016–.06 Ml. (Cc.)).

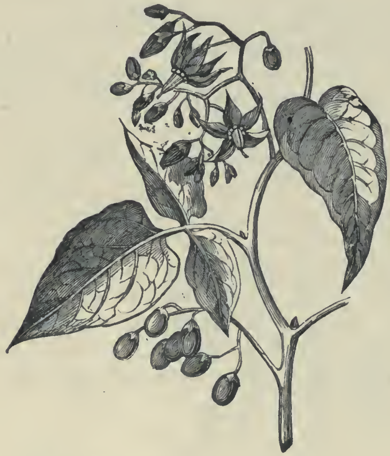


FIG. 349.—*Solanum Dulcamara.*

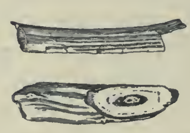


FIG. 350.—Dulcamara (Nat.).

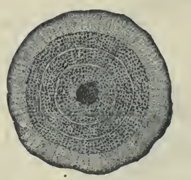


FIG. 351. — Dulcamara: transverse section of a branch magnified 3 diam.

Prep.: 1. *Emplastrum Capsici.* Capsicum Plaster. (Syn., Emp. Capsic.; Fr. Sparadra(pum) Capsici (de Capsique); Ger. Capsicumpflaster.)

Manufacture: Apply oleoresin of capsicum to the surface of rubber plaster so as to form a thin, even coating, leaving a margin around the edges; each 15 □ Cm. of spread plaster contains .25 Gm. of oleoresin of capsicum—requiring about 6♏; .4 Ml. (Cc.).

2. *Tinctura Capsici.* Tincture of Capsicum. (Syn., Tr. Capsic.; Fr. Teinture de Piment des jardins; Ger. Spanischpfeffertinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: 95 p. c. alcohol. Dose, ♏x–60 (.6–4 Ml. (Cc.)).

Unoff. Preps.: Extract, dose, gr. ½–2 (.03–.13 Gm.). *Fluidextract* (alcohol), dose, ♏j–5 (.06–.3 Ml. (Cc.)). *Infusion,* 5 p. c., dose, ʒij–4 (8–15 Ml. (Cc.)). *Unguentum Capsici* (Br.), 20 p. c.

PROPERTIES.—Stimulant, stomachic, rubefacient, condiment, diaphoretic; stimulates flow from salivary, gastric, and intestinal glands, also the stomach walls and heart.

USES.—Indigestion, dyspepsia, atonic gout, alcoholism, delirium tremens, intermittents; flatulent colic, low fevers, cholera, menorrhagia, seasickness, tonsillitis, scarlet fever, diphtheria, hemorrhoids; externally—lumbago, rheumatism, neuralgia, chilblains, relaxed uvula. Was known to the Romans, and used in E. Indies from time immemorial.

Allied Plants:

1. *Capsicum an'nuum (lon'gum).*—Fruit, official 1820–1880; Fruit 5–10 Cm. (2–4′) long, 2.5–4 Cm. (1–1⅗′) thick, oblong, conical, sometimes curved or subglobular, yellow or red, brown when dry. Known in England as pod pepper, but often sold as *chillies* or *capsicums,* and is the kind recognized by the Ger. Phar. *C. fastigia'tum.*—Fruit, once official, and like that which is now official, 8–12 Mm. (⅓–½′) long, 3–4 Mm. (⅛–⅙′) thick. *C. cerasifor'me,* fruit resembles a cherry. All three sometimes used for purposes similar to official.

2. *Sola'num Dulcama'ra, Dulcamara, Bittersweet.*—The dried young branches, official 1820–1900; Europe, Asia (N. America). Climbing, pubescent shrub, around dwellings, in thickets; stem woody at base, branching, 3–4.5 M. (10–15°) high; leaves cordate, halberd-shape, pubescent beneath; flowers purple, whitish; fruit oval red berry, many-seeded. Branches, collected when 1–2 years old, in autumn or early spring; occurs in short sections, 8 Mm. (⅓′) long, 5 Mm. (⅕′) thick, cylindrical, hollow, angular, striate, warty, bark thin, pale greenish-brown; wood greenish-yellow, in 1–2 concentric rings; odor slight, when fresh unpleasant; taste bitter, then sweet; contains dulcamarin (picroglycion, dulcarin) .4 p. c., solanine, resin, gum, wax, benzoic acid, starch, calcium lactate. Narcotic, diuretic, diaphoretic, alterative, deobstruent; large doses produce vomiting, faintness, vertigo, convulsive muscular movements, dryness and constriction of the throat, thirst, diarrhœa, weakened heart action, paralysis. Cutaneous eruptions, rheumatism, gout, bronchitis, whooping-cough, nasal, vesical, and pulmonary catarrhs, mania with strong venereal desire, neuralgia. *Poisoning:* Same as for belladonna. Dose, ʒss–1 (2–4 Gm.); fluidextract (diluted alcohol), ʒss–1 (2–4 Ml. (Cc.)). *S. panicula'tum,* S. America; tonic, diuretic, antiperiodic, vesical catarrh. *S. carolinen'se Solanum, Horse-nettle Berries:* The air-dried ripe fruit; United States; globose, shriveled, 1–2 Cm. (⅖–⅘′) broad, yellowish, fleshy; odor pepper-like, taste bitter, acrid; contains solanine, solanidine, resin, vol. oil; similar to *S. Dulcamara*—tonic, etc.; epilepsy, aphrodisiac, etc. Dose, ʒss–1 (2–4 Gm.); fluidextract (67 p. c. alcohol); tincture.

3. *Lyc'ium vulga're.*—United States, Europe; *L. af'rum,* N. Africa, and *L. umbro'sum,* S. America; leaves of all in infusion good for erysipelas and skin diseases.

BELLADONNA. BELLADONNA.

1. Belladonnæ Folia. Belladonna Leaves.
2. Belladonnæ Radix. Belladonna Root.

Atropa Belladonna, *Linné.* 1. The dried leaves and tops, with not more than 10 p. c. of stems, foreign matter, containing .3 p. c. of alkaloids. 2. The dried root, with not more than 10 p. c. of stem-bases, foreign matter, containing .45 p. c. of alkaloids.

Habitat. C. and S. Europe, Asia Minor, Algeria, in waste ground, mountainous woods; cultivated in Germany, France, England, N. America.

Syn. Deadly or Sleeping Nightshade, Death's Herb, Banewort, Mekilwort, (Poison) Black Cherry, Doft- (Dway–) berry, Dwale; Bellad. Fol., Deadly Nightshade Leaves; Bellad. Rad., Deadly Nightshade Root; Fr. Belladone, Morelle furieuse, Feuilles de Belladone, Racine de Belladone; Ger. Toll-, Wolf-Kirsche, Tollkraut, Belladonna, Tollkirschenblätter, Tollkirschenwurzel.

At'ro-pa. L. fr. Gr. Ἄτροπος = ἀ, priv., + τρέπειν, to turn—not to turn, to be inflexible. One of the mythological fates, whose office it was to cut the thread of life—*i. e.*, with this poisonous fruit or plant the functions of office could easily be performed.

Bel-la-don'na. L. *bella*, beautiful, + *donna*, a lady—*i. e.*, the berries were used by the Italian ladies as a cosmetic, and to dilate their eye pupils, thus giving them a strikingly handsome appearance.

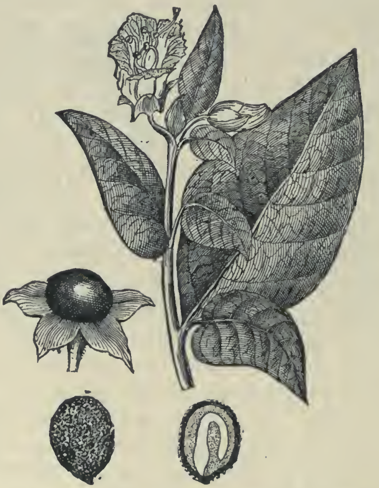


Fig. 352.—*Atropa Belladonna:* branch, fruit, seed, and section of seed, the last two magnified.

Plant.—Bushy perennial, 1–1.5 M. (3–5°) high; stems 12–25 Mm. ($\frac{1}{2}$–1′) thick, purplish, longitudinally wrinkled, older parts smooth, usually hollow, younger parts flattened, finely hairy; flowers 2.5 Cm. (1′) long, yellowish-purple, campanulate, 5's; fruit dark green berry, size of cherry, subtended by dark green calyx; seeds small, numerous. Leaves, broadly ovate, 6–20 Cm. (2.5–8′) long, 4–12 Cm. ($1\frac{3}{5}$–5′) broad, acute, entire, narrowed into long petiole, brownish-green, under surface grayish-green, papillose, slightly hairy; usually much twisted, matted, crumpled, but pliable and extensible upon soaking in water; odor distinct, especially on moistening; taste bitter, acrid. Powder, dark green; microscopically—irregular fragments of leaf tissues, woody elements, calcium oxalate micro-crystals (sandy), few glandular and non-glandular hairs, tracheæ, starch grains, pollen grains, long bast-fibres (stem)—no raphides (abs. of *Phytolacca decandra*, leaves, stems). Dose, gr. $\frac{1}{2}$–3 (.03–.2 Gm.). Root, in cylindrical, tapering pieces, 10–30 Cm. (4–12′) long, .5–2.5 Cm. ($\frac{1}{5}$–1′) thick, usually split longitudinally, pale brownish-gray, longitudinally wrinkled, outer layers of periderm rather soft, frequently abraded showing lighter patches; fracture nearly smooth, mealy, emitting characteristic puff of dust (starch grains); internally whitish, with distinct cambium zone, yellowish wood wedges; nearly inodorous; taste sweetish, bitterish, acrid. Powder, light brown; microscopically—numerous starch grains, .003–.030 Mm. ($\frac{1}{8325}$–$\frac{1}{825}$′) broad, calcium oxalate micro-crystals, fragments of cork cells, tracheæ, wood-fibres, occasional long bast-fibres (stem). Should be kept in tightly-closed containers, adding occasionally a few drops of chloroform or carbon tetrachloride to prevent insect attack. Dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.).

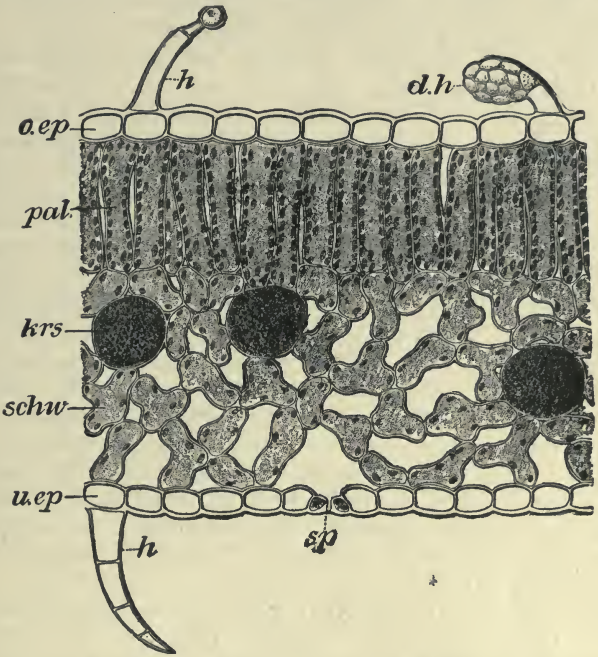


Fig. 353.—Belladonna leaf cross-section: *o.ep*, upper epidermis with a glandular hair having long stem with little head (*h*), and a very short-stemmed glandular hair with large many-celled head (*d.h*); *pal*, palisade tissue; *krs*, sand-crystal cell; *schw*, spongy parenchyma; *u.ep*, lower epidermis with stomata (*sp*), and a single multicellular hair (*h*), magnified 175 diam.
]

ADULTERATIONS.—LEAVES: Digitalis, hyoscyamus, stramonium, ailanthus—long tapering base; verbascum—hairy, more or less lobed, differently colored and veined; black nightshade (*Solanum ni'grum*)—leaves smaller, dentate; scopola (*Scopola carniolica*)—leaves oblong-ovate, without stomata on upper surface, often 15–20 p. c.; poke (*Phytolacca decandra*)—leaves detected by the more angular epidermal cells and calcium oxalate needles; ROOT: Rare—roots of allied species, rhizome of scopola—darker, tough, flexible, numerous stem-scars, transverse root-scars, thin bark, without short snapping fracture and puff of dust; medicago (*Medica'go sati'va*)—solid crown-branches, thinner bark; althæa—fracture tough; poke-root. Roots of inula, spikenard, and parsley have similar appearance.

Commercial.—Plant prefers limestone soil and grows in stony, shady, bushy places, along walls, amid rubbish. Of the wild and cultivated all parts practically are active alike, but the English is considered superior to the German. Leaves and roots should be collected when strongest—from plants 2–4 years old, the former in flowering, June–July, the latter in autumn or early spring; if younger the root fracture is horny, resinous, if older, woody, splintery, both indicating deficiency in alkaloids, which reside chiefly in the bark; large pieces often are split to avoid damage in drying, while hyoscyamine, under various conditions in making the preparations, is converted into atropine.

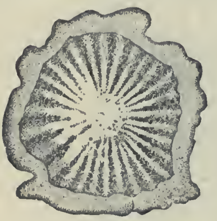


FIG. 354. — Belladonna root: transverse section, magnified 3 diam.

CONSTITUENTS.—Atropine, .2–.6 p. c., Belladonnine, Hyoscyamine, scopolamine (hyoscine), atropamine, atrosin, malic acid, starch (autumn), sugar (spring); leaves have, in addition: chlorophyll, choline (bilineurine), albumin, mucilage, wax, asparagin, chrysatropic acid (scopoletin), succinic acid, nitrates, ash 7 (root)–20 (leaves) p. c. (Ca, Mg, K, carbonates).

Atropina, Atropine, $C_{17}H_{23}NO_3$, *official.*—(Syn., Atrop., Atropia; Fr. Atropine; Ger. Atropinum, Atropin.) This alkaloid in commerce always contains a little hyoscyamine, which is separated with difficulty, as they are extracted together by agitating an alcoholic tincture of the root with slaked lime, in order to decompose the natural salt and liberate the alkaloid, which remains in solution; acidify filtrate with diluted sulphuric acid, concentrate to remove alcohol, fat, resin, shake with chloroform to remove chlorophyll, and to filtrate add potassium carbonate in excess; purify by dissolving washed precipitate (atropine) in alcohol, add water until slightly turbid, crystallize. It is in white rhombic prisms, odorless, bitter, acrid, soluble in water (455), hot water (90), alcohol (2), glycerin (27), chloroform (1), ether (25), aqueous solution alkaline, melts at 115° C. (239° F.); forms numerous salts (hydrobromide, hydrochloride, nitrate, sulphate, etc.). *Tests:* 1. Evaporate .01 Gm. + few drops of nitric acid to dryness—yellow residue, which upon cooling, + few drops of alcoholic potassium hydroxide T. S., + fragment of potassium hydroxide—intense violet (abs. of strychnine, which masks reaction). 2. Solution in dilute hydrochloric acid (1 in 50) + gold chloride T. S.—lusterless precipitate (dist. from hyoscyamine—lustrous precipitate); incinerate .1 Gm.—ash non-weighable. 3. Heated with barium hydroxide becomes hydrolized into tropic acid, $C_9H_{10}O_3$, and tropine, $C_8H_{15}NO$—tropine tropate—and by heating these together synthetic atropine results; other tropines (alkaloids, compound esters) have been formed with various organic acids, as tropine mandelate, which yields homatropine. *Impurities:* Foreign alkaloids (platinic chloride T. S.—precipitate), apoatropine, belladonnine (ammonia water—turbidity), hyoscyamine, readily carbonizable substances (sulphuric or nitric acid—yellow, brown). Exercise great caution in tasting, using very dilute solution. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{120}$–$\frac{1}{60}$ (.0005–.001 Gm.).

Atropinæ Sulphas, Atropine Sulphate, $(C_{17}H_{23}NO_3)_2.H_2SO_4$, *official.*—(Syn., Atrop. Sulph., Sulphate of Atropia; Fr. Sulfate d'Atropine; Ger. Atropinum sulfuricum, Atropinsulfat, Schwefelsaures Atropin.) Obtained by dissolving atropine mixed with water by means of diluted sulphuric acid, neutralizing, evaporating, or dissolve in alcohol, neutralize with sulphuric acid, evaporate; as such is accompanied usually by small amount of hyoscyamine sulphate, from which it cannot readily be separated. It is a white crystalline powder or in microscopic needles and prisms, efflorescent in dry air, odorless, soluble in water (.4), alcohol (5), boiling alcohol (2.5), glycerin (2.5), chloroform (420), ether (3000); aqueous solution neutral; melts at 190° C. (374° F.). Exercise great caution in tasting, using very dilute solution. Dose, gr. $\frac{1}{120}$–$\frac{1}{60}$ (.0005–.001 Gm.).

Homatropinæ Hydrobromidum, Homatropine Hydrobromide, $C_{16}H_{21}NO_3.HBr$, *official.*—(Syn., Homatrop. Hydrobr., Homatropine Bromide; Fr. Bromhydrate d'Homatropine; Ger. Homatropinum hydrobromicum, Bromwasserstoffsaures Homatropin (Oxytoluyltropein).) Obtained by the condensation of tropine and mandelic acid—heating tropine, $C_8H_{15}NO$, with mandelic acid (tropine mandelate) for several days on a water-bath, in the presence of dilute (12 p. c.) hydrochloric acid, adding ammonia water and extracting liberated alkaloid with chloroform, evaporating chloroformic solution, neutralizing with hydrobromic acid, crystallizing. It is a white, odorless, crystalline powder, rhombic prisms, soluble in water (6), alcohol (40), chloroform (420), hot alcohol (12); insoluble in ether; aqueous solution (1 in 20) neutral; melts at 212° C. (414° F.) with partial decomposition. *Tests:* 1. Shake 1 Ml. (Cc.) of aqueous solution (1 in 10) + chloroform 2 Ml. (Cc.), + few drops of chlorine water—chloroform becomes brownish. 2. Add to aqueous solution iodine T. S.—brown precipitate; silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid; incinerate .1 Gm.—ash non-weighable. *Impurities:* Atropine, hyoscyamine, scopolamine (hyoscine), foreign alkaloids (with tannic acid T. S. or platinic chloride T. S.—precipitate). Exercise great caution in tasting, using very dilute solution. Should be kept dark, in well-closed containers. Superior to atropine in being less toxic, in decreasing instead of increasing heart-rate and blood-pressure, and in the effects passing off in one-fourth the time—1–2 days; inferior to it where lasting mydriasis is desired. Used to correct anomalies of refraction, in 1–2 p. c. solutions. Dose, gr. $\frac{1}{120}$–$\frac{1}{60}$ (.0005–.001 Gm.).

Belladonnine, $C_{17}H_{23}NO_4$, **Oxyatropine** and **Atropamine** (**Apoatropine, Aposterpine**), $C_{17}H_{21}NO_2$.—All these may be one and the same; yellow powder decomposed very easily by mineral acids.

Hyoscyamine (daturine, duboisine of other plants).—This has the same formula as atropine and scopolamine (hyoscine), but is more soluble in water and diluted alcohol, and forms gold salts with a different fusing-point; is converted into atropine by alkaloids in alcoholic solution.

Atrosin (*β-methyl æsculetin*).—This is the red coloring matter, fluorescent.

Malic Acid.—This holds the alkaloids in combination.

The young roots contain only hyoscyamine, those of 8–10 years old also atropine; alkaloids are mostly in the bark, hence large woody roots should be rejected.

Preparations.—I. Leaves: 1. *Extractum Belladonnæ Foliorum.* Extract of Belladonna Leaves. (Syn., Ext. Bellad. Fol., Extractum Belladonnæ Foliorum Alcoholicum; Fr. Extrait de Belladone; Ger. Belladonnaextrakt (Spirituöses), Tollkirschenextrakt.)

Manufacture: Pilular, macerate percolate 100 Gm. with 75 p. c. alcohol until exhausted (300 Ml. (Cc.)), reclaim alcohol, evaporate residue at 70° C. (158° F.) to pilular consistence, frequently stirring, mix thoroughly; after assay add enough glucose for extract to contain 1.25 p. c. of total alkaloids, mix thoroughly. Powdered, macerate, percolate 100 Gm. with alcohol, reserve first 100 Ml. (Cc.) and continue until exhausted (100 Ml. (Cc.)); reclaim alcohol from second percolate until residue in still is 10 Ml. (Cc.), to which add first reserve and distil until residue of syrupy consistence; transfer to a dish, rinse still with little warm alcohol, which add to dish and evaporate at 70° C. (158° F.) to pilular consistence, frequently stirring, add dried starch 5 Gm., heat, with stirring, until nearly dry, thoroughly incorporate magnesium oxide 2 Gm., expose to current of warm air until dry, pulverize; after assay add enough dried starch for extract to contain 1.25 p. c. of total alkaloids, mix thoroughly, pass through fine sieve; contains 1.18–1.32—1.25 p. c. of the alkaloids; 1 Gm. represents about 4 Gm. of the drug. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. $\frac{1}{4}$–$\frac{1}{2}$ (.016–.03 Gm.).

Preps.: 1. *Emplastrum Belladonnæ.* Belladonna Plaster. (Syn., Emp. Bellad.; Fr. Emplâtre d'Extrait de Belladone; Ger. Belladonnapflaster.)

Manufacture: Melt adhesive plaster 70 Gm., add extract of belladonna leaves 30 Gm., softened by heat, stir until homogeneous, cool; contains 30 p. c. of extract of belladonna leaves, yielding .35–.40 p. c. of total alkaloids.

2. *Unguentum Belladonnæ.* Belladonna Ointment. (Syn., Ung. Bellad.; Fr. Pommade Belladonée; Ger. Tollkirschensalbe.)

Manufacture: Triturate pilular extract of belladonna leaves 10 Gm. with diluted alcohol 5 Ml. (Cc.), until a smooth mixture, incorporate hydrous wool fat 30 Gm., add benzoinated lard 55 Gm., mix thoroughly.

2. *Tinctura Belladonnæ Foliorum.* Tincture of Belladonna Leaves. (Syn., Tr. Bellad. Fol.; Br. Tinctura Belladonnæ; Fr. Teinture de Belladone; Ger. Belladonnatinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: diluted alcohol—percolate 95 Ml. (Cc.), assay, and add enough menstruum for the 100 Ml. (Cc.) to contain .027–.033—.03 Gm. of total alkaloids. Dose, ♏j–30 (.06–2 Ml. (Cc.)).

II. Root: 1. *Fluidextractum Belladonnæ Radicis.* Fluidextract of Belladonna Root. (Syn., Fldext. Bellad. Rad., Fluid Extract of Belladonna Root; Br. Extractum Belladonnæ Liquidum; Fr. Extrait fluide de Racine de Belladone; Ger. Tollkirschen(wurzel)fluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: 80 p. c. alcohol; reserve first 80 Ml. (Cc.), in which dissolve soft extract, assay, and add enough menstruum for the 100 Ml. (Cc.) to contain .405–.495—.45 Gm. of total alkaloids. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

Prep.: 1. *Linimentum Belladonnæ.* Belladonna Liniment. (Syn., Lin. Bellad.; Fr. Liniment de Belladone; Ger. Belladonnaliniment.)

Manufacture: 5 p. c. Dissolve camphor 5 Gm. in fluidextract of belladonna root 80 Ml. (Cc.), then add latter q. s. 100 Ml. (Cc.); mix thoroughly; used externally.

Unoff. Preps.: I. Leaves: *Extractum Belladonnæ Viride*—express juice, heat, strain, evaporate, add coloring matter strained out, dose, gr. $\frac{1}{4}$–1 (.016–.06 Gm.). *Fluidextract,* dose, ♏$\frac{1}{3}$–3 (.02–.2 Ml. (Cc.)). *Infusion,* 5 p. c., dose, ʒj–3 (4–12 Ml. (Cc.)). *Succus Belladonnæ*—expressed juice (3), and alcohol (1), dose, ♏v–15 (.3–1 Ml. (Cc.)). II. Root: *Abstract,* dose, gr. $\frac{1}{10}$–1 (.006–.06 Gm.). *Extract,* dose, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.). *Suppositoria Belladonnæ* (Br.), each contains $\frac{1}{60}$ gr.(.001 Gm.) of alkaloids. III. Atropine: *Lamellæ Atropinæ* (Br.), each $\frac{1}{5000}$ gr. (.000013 Gm.). *Lamellæ Homatropinæ* (Br.), each $\frac{1}{100}$ gr. (.0006 Gm.). *Oleate,* 2 p. c.; used externally. *Unguentum Atropinæ* (Br.) 2 p. c.

Properties.—Sedative, narcotic, diuretic, mydriatic, antispasmodic, anodyne. Like all medicines that act through nervous system, small doses stimulate, large ones paralyze. Diminishes most secretions (salivary, mammary, skin, stomach, liver, pancreas, intestines) by paralyzing peripheral nerve-endings, increases peristalsis by paralyzing terminations of involuntary intestinal muscles; dilates pupil, increases pulse and urine by paralysis; often causes erythematous eruption.

Uses.—Lessens pain, rheumatism, gout, neuralgia, sciatica, cancer, pelvic derangements, encephalitis, meningitis, myelitis, erysipelas. Inflammation of lungs, iris, bladder, kidneys, breast, acute catarrh, sore throat, asthma, whooping-cough, spasms, constipation, spermatorrhœa, prophylactic against scarlet fever. Locally in abscesses, carbuncles, skin diseases, scarlet fever rash, to check mammary secretion, relieve vomiting of pregnancy; smoke leaves with opium for phthisis. Atropine (hypodermic) is the sheet-anchor in poisoning by opium, physostigma, and hydrocyanic acid.

Poisoning: Within 15 minutes have dryness of mouth, dry burning throat, dilated pupils, intense thirst which nothing allays, indistinct and double vision, giddiness, burning in stomach, nausea, difficult deglutition, hallucinations, delirium or fits of laughter, rambling talk, feeble and rapid pulse, cold extremities, coma, convulsions, death; sometimes face red and swoolen, inability to urinate. Give emetics or use pump, enemas, tannic acid, then morphine, physostigmine, or pilocarpine (hypodermic) for nervous disturbance; stimulants, brandy, caffeine, strychnine, artificial respiration, cold to head, warmth to feet, empty bladder. Children often eat the sweet fruit in excess, and should receive this treatment.

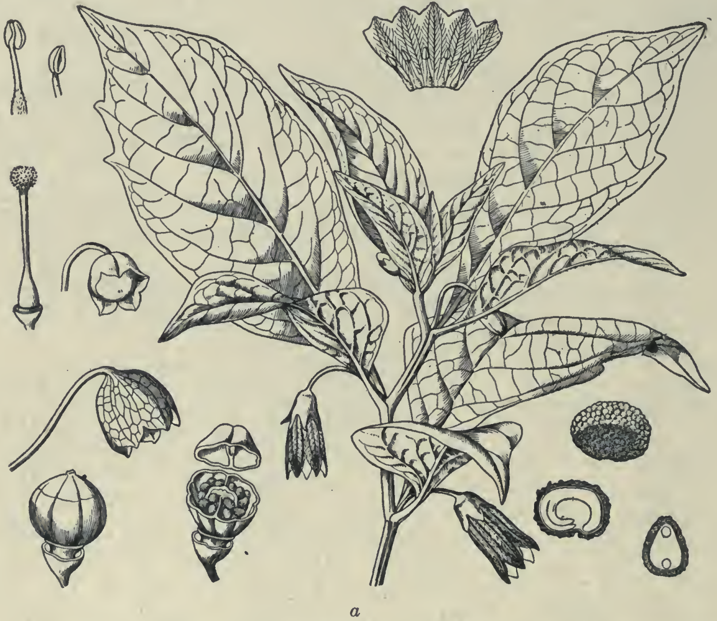


Fig. 355.—*Scopola carniolica: a*, flowering and fruiting branch (¼ nat. size); also flower, stamen, anther, pistil, fruit, seed, enlarged.

Incompatibles: Muscarine, physostigmine, pilocarpine, aconite, opium, tannin, caustic alkalies (evolve ammonia), quinine.

Synergists: Mydriatic drugs (hyoscyamus, stramonium, duboisia).

Allied Plants:

1. *Sco'pola carniol'ica, Scopola.*—The dried rhizome containing .5 p. c. of mydriatic alkaloids, official 1900–1910; C. Europe, Germany, Austro-Hungary, Carniola. Shrub, 20–60 Cm. (8–24′) high, usually branchless; leaves oblong-lanceolate, wavy or notched toward apex, petiolate, reticulate; flowers tubular, campanulate, brownish-purple;

fruit capsule, circumscissile, dehiscent. Rhizome flexuous, cylindraceous, mostly in pieces 2.5–7.5 Cm. (1–3′) long, .8–1.6 Cm. ($\frac{1}{3}$–$\frac{2}{3}$′) thick, often split before drying; upper surface with large, closely set cup-shaped stem-scars, margins irregularly contracted, brownish, longitudinally wrinkled, obscurely annulate, nodular-roughened, fracture short, sharp; wood indistinctly radiate, central pith horny; nearly inodorous; taste sweetish, bitterish, acrid; solvents: alcohol (80 p. c.), water partially; contains scopolamine .05 p. c., hyoscyamine .5 p. c., atropine, scopoletin, ash 7–10 p. c. Mydriatic, analgesic, hypnotic, antiphlogistic; glaucoma, ptyalism, hyperidrosis. Should not be given in renal affection nor in advanced age, and cases of poisoning should be treated as in belladonna. Dose, gr. 1–3 (.06–.2 Gm.); extract, gr. $\frac{1}{4}$–$\frac{1}{2}$ (.016–.03 Gm.); scopolamine, gr. $\frac{1}{250}$–$\frac{1}{60}$ (.00025–.001 Gm.). *S. japon′ica, Japanese Belladonna,* plant resembles very closely *S. carniolica,* differing only in having the style curved, calyx-teeth unequal, leaves less obovate with longer petioles; rhizome 10 Cm. (4′) long, 12 Mm. ($\frac{1}{2}$′) thick; this also yields atropine, scopolamine, etc.

2. *Mandrag′ora officina′lis* (*Atropa mandragora*), together with var. *autumna′lis,* having blue flowers, and var. *verna′lis,* white flowers; S. Europe—all are acaulescent plants, having constituents similar to those of belladonna.

HYOSCYAMUS. HYOSCYAMUS.

Hyoscyamus niger, *Linné.*	The dried leaves and flowering or fruiting tops, containing not less than .065 p. c. of alkaloids.

Habitat. Europe, Asia, waste places, neglected ruins, old gardens, sandy soil; naturalized in N. America (New England to Michigan); cultivated in England, etc.

Syn. Hyosc., Henbane, Black Henbane, Hog's-bean, Poison Tobacco, Fetid (Stinking) Nightshade, Insane-root, Henbell; Br. Hyoscyami Folia; Fr. Jusquiame noire, Feuilles Jusquiame noire, Belene, Chenile; Ger. Bilsenkrautblätter.

Hy-os-cy′a-mus. L. fr. Gr. ὑός, a hog, + κύαμος, a bean, hog bean—*i. e.,* its fruit (bean) acts on swine and fowls, as a poison or intoxicant, but cows, horses, dogs, and goats can tolerate a great quantity.

Ni′ger. L. black—*i. e.,* inside throat of flowers purplish-black.

Hen′bane. Hen + bane—i. e., whole plant fatal to poultry—bane to hens.

Plant.—Biennial herb, .6–1.3 M. (2–4°) high; stem subcylindrical, somewhat compressed, longitudinally wrinkled, green, appearing 2nd year, covered with long, soft, jointed, glandular, white hairs, viscid, clammy, fetid odor; root large, brown, interior white, wrinkled, compact, fibrous; flowers May–June, 3 Cm. (1$\frac{1}{5}$) long, anthers and style purple. Leaves, usually much wrinkled (with numerous stems and flowering or fruiting tops), 25 Cm. (10′) long, 10 Cm. (4′) broad, ovate-oblong, inequilateral, lower with short petiole, upper sessile, acute, coarsely and angularly 1–4-toothed (lobed), grayish-green, glandular-hairy, particularly lower surface; flowers nearly sessile with urn-shaped (urceolate), unequally 5-toothed calyx, yellowish, campanulate, purple net-veined corolla; fruit 2-locular, globular pyxis (capsule), 12 Mm. ($\frac{1}{2}$′) thick, enclosed in large urn-shaped, 5-toothed calyx;

stems 3–10 Cm. (1$\frac{1}{5}$–4′) long, 2–5 Mm. ($\frac{1}{12}$–$\frac{1}{5}$′) thick, odor heavy, distinctive; taste somewhat bitter, acrid. POWDER, grayish-green; microscopically—calcium oxalate crystals (prisms, twins, rosette aggregates), numerous hairs (glandular and non-glandular), stomata, tracheæ, sclerenchymatous fibres, pollen grains; *H. mu'ticus* (leaves, powder) recognized by characteristic, branching, non-glandular hairs. *Solvents:* diluted alcohol; boiling water partially. Dose, gr. 2–10 (.13–.6 Gm.).

ADULTERATIONS.—Leaves of allied species, also of stramonium, digitalis, belladonna, verbascum.

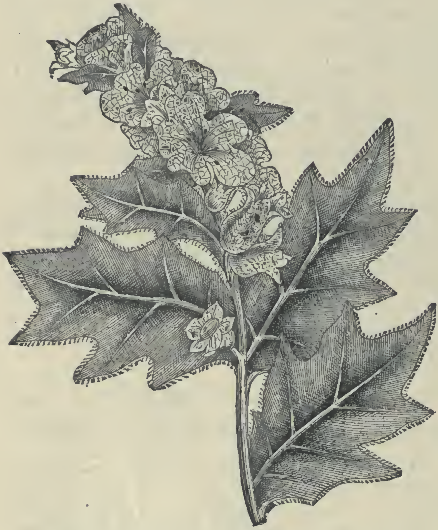


FIG. 356.—*Hyoscyamus niger:* flowering branch.

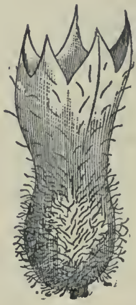


FIG. 357.—Hyoscyamus calyx, containing capsule, natural size.

Commercial.—Plant by cultivation has become so diversified as to give varieties and almost species, all differing somewhat in medicinal strength; the annual form is usually .3–.6 M. (1–2°) high, having smaller parts, leaves less toothed, and corolla faintly or not purple-veined; the biennial form produces in the first year a fleshy fusiform root (resembling that of parsley, for which it has been eaten with serious results), and a radical rosette of large, coarsely toothed (lobed), long petioled leaves, and in the second year the flowering and fruiting stem, after which it dies; in this latter stage the root is spongy, hollow, while the radical leaves are wanting, those of the stem being broader, shorter petioled, and sessile at apex. The stem leaves of the biennial plant are, as a rule, stronger and should be collected when two-thirds of the flowers have expanded; leaves of the first year, as also those of the annual plant, are often of equal strength; the perfect biennial root is three times richer than any other portion.

CONSTITUENTS.—Mydriatic alkaloids .3–.557 p. c.: Hyoscyamine, Scopolamine (Hyoscine), Hyoscipicrin, choline, mucilage, albumin, chlorophyll, potassium nitrate 2 p. c., ash 30 p. c. In the seeds also fixed oil 25 p. c.

Hyoscyamine, $C_{17}H_{23}NO_3$.—A crystalline alkaloid obtained from the mother-liquors of atropine, or by freeing hyoscyamus seeds of fat by petroleum benzin, drying, exhausting with alcohol (85 p. c.), adding hydrochloric acid, reclaiming alcohol, treating filtered residue again with petroleum benzin (fat, coloring matter), rendering alkaline with ammonia or potassium carbonate, shaking with repeated portions of chloroform, evaporating chloroformic solution, purifying by solution in dilute sulphuric acid, filtering, crystallizing; to obtain alkaloid render aqueous solution alkaline, extract with chloroform, evaporate; yield—leaves: .042–.224 p. c.; seed: .08–.16 p. c.; root: .006–.307 p. c. Occurs in white silky needles; if impure, deliquescent, becoming brown; identical with duboisine, isomeric with atropine, into which it is converted by heating to 120° C. (248° F.) for 6 hours; it also splits into tropine, $C_8H_{15}NO$, and tropic acid, $C_9H_{10}O_3$, and forms numerous salts (hydrobromide, hydrochloride, sulphate, etc.).

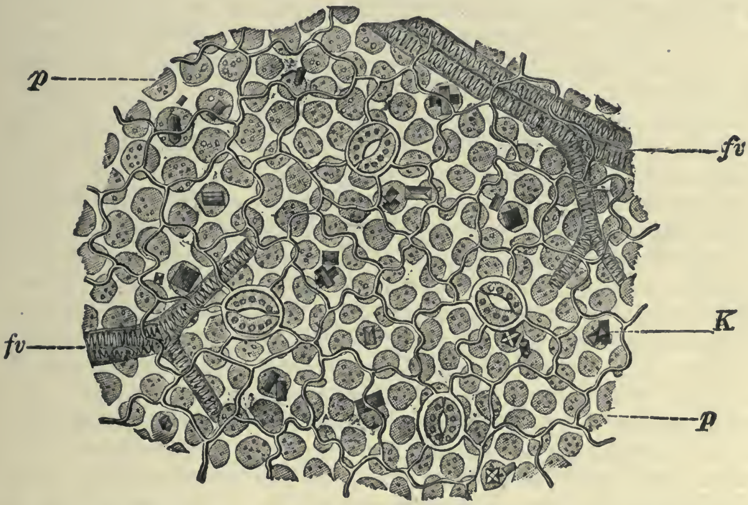


FIG. 358.—*Hyoscyamus:* view of upper side of leaf revealing through epidermis the stomata and crystals (*K*) and palisade cells (*p*), and fibro-vascular bundles (*fv*).

Hyoscyaminæ Hydrobromidum, Hyoscyamine Hydrobromide, $C_{17}H_{23}NO.HBr$, *official*.—(Syn., Hyoscyamin. Hydrobr., Hyoscyamine Bromide, Hyoscyaminæ Hydrobromas; Fr. Bromure d'Hyoscyamine; Ger. Hyoscyaminum hydrobromicum, Hyoscyaminbromid.) This hydrobromide of the preceding alkaloid is obtained by dissolving hyoscyamine (10) in 25 p. c. hydrobromic acid (11), concentrating, crystallizing; it is in white, prismatic crystals, odorless, deliquescent, soluble in water, alcohol (2.5), chloroform (1.7), ether (2260); aqueous solution (1 in 20) neutral, lævorotatory, melts at 152° C. (306° F.). *Tests:* 1. Aqueous solution + silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid. 2. Shake 1 Ml. (Cc.) of aqueous solution (1 in 10) with chloroform 2 Ml. (Cc.), + few drops of chlorine water—chloroform brownish. 3. Add .01 Gm. to 5 drops of nitric acid, evaporate to dryness; residue + alcoholic potassium hydroxide T. S. —violet color; incinerate .1 Gm.—ash non-weighable. *Impurities:* Atropine, scopolamine, alkaloids, carbonizable substances. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{120}$–$\frac{1}{60}$ (.0005–.001 Gm.).

Scopolamine (Hyoscine, Amorphous Hyoscyamine), $C_{17}H_{21}NO_4$. This exists in various plants of the Solanaceæ, being chemically and otherwise identical with hyoscine, and thought to consist of two bases, scopolamine and atrosin (optically inactive scopolamine); it is obtained from the mother-liquor of hyoscyamine by adding gold chloride, to form a less soluble gold double salt, which crystallizes out, dissolving this in water, removing gold by hydrogen sulphide, precipitating scopolamine with potassium carbonate. It is a semi-liquid tenacious mass, isomeric with hyoscyamine, lævorotatory, yielding tropic acid and pseudotropine, $C_8H_{15}NO$; forms numerous salts (hydrobromide, hydrochloride, sulphate, etc.).

Scopolaminæ Hydrobromidum, Scopolamine Hydrobromide, $C_{17}H_{21}NO_4.HBr + 3H_2O$, *official.*—(Syn., Scopolamin. Hydrobrom., Hyoscine Hydrobromide, Scopolamine Bromide (Hydrobromate); Fr. Bromhydrate d'Hyoscine; Ger. Skopolaminhydrobromid.) Obtained by dissolving scopolamine in slight excess of diluted hydrobromic acid, concentrating, crystallizing. It is in colorless, transparent, rhombic crystals, some large; odorless, slightly efflorescent, lævorotatory (use great care in tasting and then only in dilute solution); soluble in water (1.5), alcohol (20), slightly in chloroform, insoluble in ether; aqueous solution (1 in 20) neutral, slightly acid; melts when anhydrous at 191° C. (376° F.). *Tests:* 1. Dry to constant weight—loses 13 p. c.; over sulphuric acid—loses water of crystallization slowly; incinerate .1 Gm. —ash non-weighable. 2. Add .01 Gm. to 5 drops of nitric acid, evaporate to dryness, add alcoholic potassium hydroxide T. S.—violet color; aqueous solution with silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid. 3. Shake aqueous solution (1 in 20) 1 Ml. (Cc.), to which a few drops of chlorine water have been added, with chloroform 2 Ml. (Cc.)—chloroform brownish color. *Impurities:* Apoatropine, morphine, foreign alkaloids, carbonizable substances. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{250}$–$\frac{1}{100}$ (.00025–.0006 Gm.); hypodermically, gr. $\frac{1}{400}$–$\frac{1}{200}$ (.00015–.0003 Gm.).

Hyoscipicrin, $C_{27}H_{52}O_{14}$.—A neutral, bitter glucoside, soluble in water, alcohol, precipitated by tannin, converted by hydrochloric acid into fermentable sugar, and a yellowish, acrid, bitter resin.

PREPARATIONS.—1. *Extractum Hyoscyami.* Extract of Hyoscyamus. (Syn., Ext. Hyosc., Extract of Henbane; Fr. Extrait de Jusquiame; Ger. Bilsenkrautextrakt.)

Manufacture: Macerate, percolate 100 Gm. with 75 p. c. alcohol until exhausted, reclaim alcohol, evaporate residue at 70° C. (158° F.) to pilular consistence, frequently stirring, mix thoroughly; after assay add enough glucose for extract to contain .25 p. c. of total alkaloids; contains .22–.28—.25 p. c. of the alkaloids; mix thoroughly; 1 Gm. represents about 4 Gm. of the drug. Dose, gr. ½–2 (.03–.13 Gm.).

2. *Fluidextractum Hyoscyami.* Fluidextract of Hyoscyamus. (Syn., Fldext. Hyosc., Fluid Extract of Hyoscyamus, Fluidextract of Henbane; Fr. Extrait fluide de Jusquiame; Ger. Bilsenkrautfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: 75 p. c. alcohol; after dissolving soft extract in the reserve, assay, and add enough menstruum for the 100 Ml. (Cc.) to contain .055–.075—.065 Gm. of total alkaloids. Dose, ♏ij–10 (.13–.6 Ml. (Cc.)).

2. *Tinctura Hyoscyami.* Tincture of Hyoscyamus. (Syn., Tr. Hyoscy., Tincture of Henbane; Fr. Teinture de Jusquiame; Ger. Bilsenkrauttinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: diluted alcohol—percolate 95 Ml. (Cc.), assay, and add enough menstruum for the 100 Ml. (Cc.) to contain .0055–.0075—.0065 Gm. of total alkaloids. Dose, ʒss–1 (2–4 Ml. (Cc.)).

Unoff. Preps.: Abstract (alcohol), dose, gr. 1–5 (.06–.3 Gm.). *Extractum Hyoscyami Viride*—express juice, heat, strain, evaporate, add coloring matter strained out, dose, gr. 2–8 (.13–.5 Gm.). *Infusion,* 5 p. c., dose, ʒj–3 (4–12 Ml. (Cc.)). *Compound Oil,* oils of lavender, peppermint, rosemary, thyme, each .2, infused oil of hyoscyamus q. s. 100. *Succus Hyoscyami*—expressed juice (3), and alcohol (1), dose, ʒss–1 (2–4 Ml. (Cc.)). *Oleum Hyoscyami Infusum* (leaves 10, alcohol 10, ammonia water .2, sesame oil 80); use externally. *Baume Tranquille* (leaves of hyoscyamus, stramonium, belladonna, tobacco, poppy, black nightshade, āā 40 parts + aromatic herbs 12 kinds āā 10 + olive oil 1,000); used externally.

Properties.—Anodyne, hypnotic, narcotic, mydriatic, laxative, carminative, similar to belladonna, stramonium, and duboisia, but less powerful and irritating, yet the most calmative and hypnotic of the group, sedative to urinary tract. Hyoscyamine is less active than atropine; it is more an anodyne or anæsthetic than narcotic or soporific, depresses spinal but excites cerebral function. Scopolamine (hyoscine) is much stronger than hyoscyamine, being a powerful cerebral and spinal sedative; lessens pulse and respiration; habitually used produces muscular paralysis, violent delirium.

Uses.—Mostly with children, and where opium is contraindicated; acute and chronic mania, delusional insanity, insomnia with hallucinations, delirium tremens, monomania of hypochondriacs, whooping-cough, nervous cough, colics, tremor in paralysis, mercurial poisoning, locomotor ataxia, irritation of bladder, constipation, chorea, tetanus, morphine-habit, corrective to griping and nauseating medicine.

Poisoning: Same as for belladonna; but for scopolamine (hyoscine) use chiefly hydrated chloral.

Incompatibles, Synergists: Same as those of belladonna.

Hyoscyami Semen.—Official 1830–1880. These are stronger than leaves, and used mostly for extraction of alkaloids; they are roundish, reniform, flattened. 1–1.5 Mm. ($\frac{1}{25}$–$\frac{1}{16}'$) long, testa finely pitted, grayish-brown, sharp near the raised portion (dif. from stramonium seed), inodorous, taste oily, bitter, acrid. Dose, gr. 1–5 (.06–.3 Gm.).

Allied Plants:

1. *Hyoscyamus pal'lidus.*—Flowers are pale yellow and have no purple (*niger*) veins in the corolla. *H. agres'tis* (of the field, wild); small annual, .3 M. (1°) high, less villous; with leaves smaller, and fewer flowers. *H. mu'ticus,* leaves yellowish, stem remnants and calyxes longer, trichomes prominent and branched. *H. al'bus* and *H. au'reus,* the former with white flowers, the latter with golden-yellow; both less active than the official.

2. *Duboi'sia myoporoi'des.*—Australia. Small tree having properties similar to those of belladonna and hyoscyamus; leaves 7.5–10 Cm. (3–4′) long, 12–25 Mm. ($\frac{1}{2}$–1′) broad, petiolate, midrib prominent, entire, taste bitter; contains duboisine .3–1 p. c., a volatile alkaloid (mixture of hyoscyamine, scopolamine, and atropine), which forms numerous salts. Dose of leaves, gr. 1–3 (.06–.2 Gm.), duboisine hydrobromide or sulphate, gr. $\frac{1}{120}$–$\frac{1}{60}$ (.0005–.001 Gm.); used externally for eye affections, in solution (1 p. c. in water).

STRAMONIUM. STRAMONIUM.

Datura { **Stramonium,** *Linné,*
Tatula, *Linné.* }
The dried leaves, with not more than 10 p. c. of stems, foreign matter, containing .25 p. c. of alkaloids.

Habitat. Asia; naturalized universally (Europe, England, N. America, etc.).

Syn. Stramon., Jamestown Weed, Jimson Weed, Thorn-apple, Devil's (Mad) Apple, Stink-weed, Stink-wort, Devil's Trumpet, Fire-weed, Jamestown Lily, Apple of Peru; Stramonii Folia; Fr. Stramoine, Pomme Épineuse, Feuilles de Stramoine; Ger. Stechapfel, Dornapfel, Stechapfelblätter.

Da-tu'ra. L. fr. Hind. *dhatura,* a plant, or an alteration of Ar. *tatorah—i. e.,* their name for the plant.

Stra-mo'ni-um. L. contr. of Gr. *στρύκνον μανικὸν,* used by Dioscorides for this and for *Atropa Belladonna.*

Tat'u-la. L. an alteration fr. *datula—i. e.,* name given the plant by Turks and Persians.

Jimson-weed. For Jamestown, Va., where first found growing on ship rubbish.

Plants.—Coarse annual bushy herbs, rank, noxious odor; stems cylindrical, flattened, longitudinally wrinkled, occasionally 1–more-furrowed, succulent, greenish, purplish-brown, nearly solid, 1–1.5 M. (3–5°) high, 2.5–4 Cm. (1–1$\frac{3}{5}'$) thick, 2–3-branched above ground; root tapering, white; flowers June–Sept., calyx tubular, green, 4 Cm. (1$\frac{3}{5}'$) long, 5's, corolla white, purplish, tubular, funnel-shaped, 7.5–10 Cm. (3–4′) long, 5 Cm. (2′) broad, 5's; fruit capsule, 5 Cm. (2′) long, ovate, obtusely quadrangular, covered with unequal, sharp, rigid spines, 4-celled, dehiscing half-way down into 4 segments; ovary 2-carpelled, 2-celled; seeds numerous, brownish-black, angled, flattened, 4 Mm. ($\frac{1}{6}'$) long. Leaves, inequilaterally ovate, one side of base 3–12 Mm. ($\frac{1}{8}$–$\frac{1}{2}'$) below the other, 5–30 Cm. (2–12′) long, 4–15 Cm. (1$\frac{3}{5}$–6′) broad, acute, acuminate, sinuate-toothed, angled, teeth few, acute, acuminate with rounded sinuses, frequently with numerous circular perforations sometimes filled with cork; dark green, sparsely hairy, especially upon the veins, under surface light green; odor distinct, heavy, narcotic; taste unpleasant, nauseous; usually much wrinkled, loose or matted together. POWDER, brownish-green; microscopically—upon clearing fragments with hydrated chloral T. S. have numerous stomata, with 3 neighboring cells, small chloroplastids, crystals or rosette aggregates of calcium oxalate, few non-glandular hairs, few glandular hairs with 2–4-celled glandular heads, tracheæ; stem fragments show spiral tracheæ, wood parenchyma, long collenchymatous cells, parenchyma, few wood-fibres, no bast-fibres. *Solvents:* alcohol (75 p. c.); diluted alcohol; hot water partially. Dose, gr. 1–5 (.06–.3 Gm.).

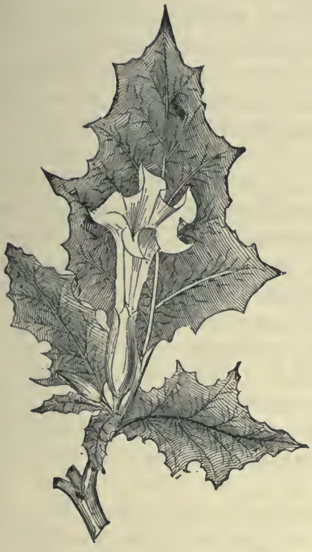


FIG. 359.—*Datura Stramonium:* flowering branch.

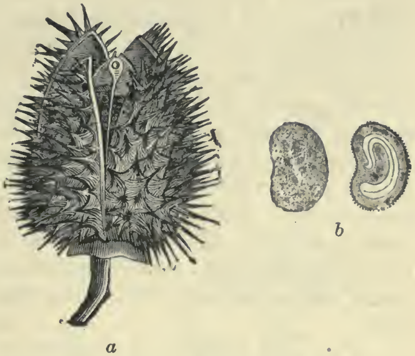


FIG. 360.—*Datura Stramonium:* a, fruit; b, stramonium seed and section, magnified 3 diam.

ADULTERATIONS.—Leaves of allied species (usually smaller), belladonna, French cultivated, and *Xan'thium Struma'rium.*

Commercial.—Plants were known possibly to the ancients, but not described until the 16th century (Gerarde), nor introduced into medicine before 1672 (Störck). They infest fields, roadsides, waste places, near houses (never in mountains or woods), and grow well with us, especially in Michigan and other Western States, all parts being medicinal. Gypsies brought leaves and seeds to Europe from Asia in the middle ages, and used the smoke therefrom to intoxicate their dupes. Leaves should be gathered while flowering, by pulling up entire plant, then quickly removing and drying, by which they often become broken or cut into pieces.

CONSTITUENTS.—Daturine .2–.4 p. c., volatile oil (containing daturic acid, $C_{17}H_{34}O_2$), chlorophyll, mucilage, albumin, potassium nitrate, ash 17–20 p. c.

Daturine.—An alkaloid combined with malic (daturic) acid, and consisting of hyoscyamine, atropine (the former usually predominating), and probably little scopolamine (hyoscine); forms salts (hydrochloride, sulphate, etc.). Dose, gr. $\frac{1}{120}$–$\frac{1}{60}$ (.0005–.001 Gm.).

Preparations.—1. *Extractum Stramonii.* Extract of Stramonium. (Syn., Ext. Stramon.; Fr. Extrait de Feuilles de Stramoine; Ger. Stechapfelblätterextrakt.)

Manufacture: Pilular, macerate, percolate 100 Gm. with 75 p. c. alcohol until exhausted, reclaim alcohol, evaporate residue at 70° C. (158° F.) to pilular consistence, frequently stirring, mix thoroughly; after assay add enough glucose for extract to contain 1 p. c. of total alkaloids, mix thoroughly. Powdered, macerate, percolate 100 Gm. with alcohol, reserve first 100 Ml. (Cc.) and continue until exhausted (100 Ml. (Cc.)); reclaim alcohol from second percolate until residue in still is 10 Ml. (Cc.), to which add first reserve and distil until residue of syrupy consistence; transfer to a dish, rinse still with little warm alcohol, which add to dish and evaporate at 70° C. (150° F.) to soft extract, frequently stirring, add dried starch 5 Gm., heat, with stirring, until nearly dry, thoroughly incorporate magnesium oxide 2 Gm., expose to current of warm air until dry, pulverize; after assay add enough dried starch for extract to contain 1 p. c. of total alkaloids, mix thoroughly, pass through fine sieve; contains .9–1.1—1 p. c. of the alkaloids; 1 Gm. represents 4 Gm. of the drug. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. $\frac{1}{6}$–$\frac{1}{2}$ (.01–.03 Gm.).

Prep.: 1. *Unguentum Stramonii.* Stramonium Ointment. (Syn., Ung. Stramon.; Fr. Pommade de Stramoine; Ger. Stechapfelsalbe.)

Manufacture: 10 p. c. Triturate until smooth mixture pilular extract of stramonium 10 Gm., diluted alcohol 5 Ml. (Cc.), incorporate hydrous wool fat 20 Gm., add benzoinated lard 65 Gm., mix thoroughly.

2. *Tinctura Stramonii.* Tincture of Stramonium. (Syn., Tr. Stramon.; Br. Tinctura Stramonii, Tincture of Stramonium; Fr. Teinture de Stramoine; Ger. Stechapfeltinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: diluted alcohol—percolate 95 Ml. (Cc.), assay, and add enough menstruum for the 100 Ml. (Cc.) to contain .0225–.0275—.025 Gm. of total alkaloids. Dose, ♏v–30 (.3–2 Ml. (Cc.)).

Unoff. Preps.: Leaves: *Fluidextract* (alcohol 65 p. c.), dose, ♏j–5 (.06–.3 Ml. (Cc.)). *Plaster. Juice* (*Succus Stramonii*). *Cigarettes.* Root: *Fomentation.*

Properties.—Narcotic, anodyne, antispasmodic, diuretic, mydriatic. Internally very similar but stronger than belladonna; weaker externally. Large doses produce dry throat, cardiac irregularity, high fever with delirium, increase sexual desire, possibly laughing and hallucinations (like in cholera, alcoholism), dizziness, fainting, red eruptions, dilated pupils, insomnia, black objects appear green; pneumogastric becomes paralyzed, thus stopping the inhibitory action, hence whole system paralyzed finally by over-stimulation, including the heart, then delirium, stupor, convulsions, death by asphyxia; in case of recovery remember nothing that has occurred; does not affect some animals, as caterpillar tribe, goats, etc.

Uses.—Insanity, mania, melancholia, epilepsy, nervous asthma (gr. 15 (1 Gm.) of leaves smoked with tobacco or sage at each paroxysm), whooping-cough, dysmenorrhœa, retention of urine, hepatic colic, laryngeal cough, chorea. Ointment in ulcers, hemorrhoids, fissures, skin diseases, poison-ivy eruptions, rheumatism bruises, sprains. In the absence of belladonna may use stramonium with good results.

Poisoning, Incompatibles, Synergists: Same as for belladonna.

Allied Plants:

1. *Datura fastuo'sa* (*al'ba*); India.—Used there as a criminal poison; capsule small, subglobular, spinous, seeds yellowish-brown, triangular, rough. *D. Met'el, Entire-leaved Thorn-apple,* Africa, S. Asia; capsule and seeds like *D. fastuosa* (*alba*), leaves nearly entire, downy. *D. sanguin'ea,* Peru; large shrub, or tree, leaves nearly entire, downy beneath, flowers large, upper half of corolla yellow, lower half blood-red.

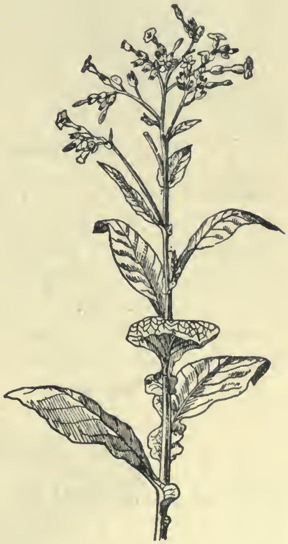


Fig. 361.—*Nicotiana Tabacum.*

2. *Fabia'na imbrica'ta, Pichi.* — Peru, Chile. Plant 1.5–2 M. (5–6°) high, growing on rocky hill-tops, resembling somewhat the pines; the woody branches are used, being resinous, with aromatic odor and taste; contain fabianine, resin, volatile oil. Diuretic, tonic, cholagogue; chronic vesical catarrh, gravel, renal, urethral, or cystic calculi. Should not be used in organic disease. Dose, gr. 5–40 (.3–2.6 Gm.).

3. *Nicotia'na Tabac'um, Tabacum, Tobacco.* — The commercial dried leaves, official 1820–1900; C. and S. America (cultivated). Coarse robust annual, 1–2 M. (3–6°) high; stem erect, unbranched, solid, green, hairy; root long, fibrous; flowers rose-color, calyx bell-shaped, hairy, viscid, corolla 4–5 Cm. (1⅗–2′) long, tubular, inflated; fruit ovate capsule, 2.5 Cm. (1′) long, opening at summit; seeds many, reniform, reticulate, brownish. Leaves, about .5 M. (20′) long, 10–15 Cm. (4–6′) wide, ovate-lanceolate, acute, entire, waved, brown, friable, hairy; odor heavy, peculiar; taste nauseous, bitter, acrid. Plant not known to be wild, and leaves in curing undergo a sweating process (chemical change) by which odor is modified through generation of a new volatile principle, and amount of nicotine decreases owing to its volatility; contains nicotine .7–5–11 p. c. (colorless oily liquid), nico-

teïne (nicotia) 2 p. c., nicotelline, nicotimine, pirolidine (?), nicotianin (tobacco camphor), tannin, resin, gum, malates, citrates, ash 14–18–27 p. c. (Ca, K, NH_4—phosphates, sulphates, malates, chlorides, nitrates); solvents: alcohol, hot water. Narcotic, sedative, diuretic, emetic, diaphoretic, cathartic, antiseptic; first stimulates (causing convulsions) then paralyzes motor nervous system (spine), produces vomiting, purging, collapse, contracted pupils, depressed then increased heart action (rapid, feeble pulse), cold extremities, death by paralysis of respiration and heart; excessive use causes dyspepsia, diminished sexual power, nervousness, angina pectoris, and in the young impairs body nutrition. So severe as to be little employed as a medicine, but may be used to relax spasms, relieve local pain, constipation, spasmodic asthma, tetanus, as an enema in intussusception, strangulated hernia, impacted cæcum, hemorrhoids, scabies, strychnine-poisoning. *Poisoning:* By tobacco or nicotine, give tannin, emetics, then strychnine (physiological antidote), alcohol, ammonia, digitalis, belladonna, iodides, artificial respiration, maintain recumbent position. Dose, gr. ½–3 (.03–.2 Gm.); wine (vinum), 10 p. c., ♏v–60 (.3–4 Ml. (Cc.)); enema tabaci, 5 p. c.; oleum tabaci (from distilling leaves—acrid, poisonous, dark brown oily liquid); aqueous extract, fluidextract, infusion ointment, poultice. *N. rus'tica, Wild Tobacco,* and *N. quadrival'vis,* Canada, Eastern U. S. *N. repan'da,* Cuba. *N. per'sica,* Persia. *N. rustica,* cultivated in Turkey, India, etc. All may be used similarly.

64. SCROPHULARIACEÆ. Figwort Family.

Skrof-u-la-ri-a'se-e. L. *Scrophulari-a* + aceæ—*i. e.,* from its efficacy in scrofula. Herbs, rarely shrubs. Distinguished by stamens 2–4–5, didynamous or 2 perfect, inserted on 2-lipped corolla-tube; flowers irregular, 4–5's, 2-lipped; ovary 2-celled, central placenta, superior, style 1; seeds many in fleshy albumin; fruit, capsule or berry; universal; bitter, astringent, emetic, purgative, diuretic, narcotic, poisonous, often cultivated for beautiful flowers.

Genus: **1. Digitalis.**

DIGITALIS. DIGITALIS.

Digitalis purpurea, *Linné.* { The carefully dried leaves, with not more than 2 p. c. of stems, flowers, foreign matter.

Habitat. W. and C. Europe; in sandy soil, edges of woods, thickets; naturalized in Australia, Oregon, etc.

Syn. Digit., Foxglove, American or Purple Foxglove, Fairy Gloves, Folks' or Ladies' Glove, Dog's Finger, Fairy Fingers, Dead Men's Bells, Finger Flower, Thimbles, Fairy Cap, Lion's Mouth, Scotch Mercury, Throatwort, Rabbit's flower; Br. Digitalis Folia; Fr. Feuilles de Digitale pourprèe (de grande Digitale), Doigtier; Ger. Fingerhutblätter.

Dig-i-ta'lis. L. pertaining to the fingers, fr. *digitus,* a finger—*i. e.,* the finger-shaped corolla, named by Fuchs, 1542, after Ger. *fingerhut,* a thimble.

Pur-pu're-a. L. *purpureus,* purple-colored—*i. e.,* its purple flowers.

Foxglove. Corruption of *Folks' glove, Folk,* synonym of *Fairies.*

SCROPHULARIACEÆ

Plant.—Biennial or perennial, succulent, downy, leafy herb, .6–1.5 M. (2–5°) high; flowers July–Aug., tubular, campanulate, 5-lobed, outside purple, inside dark-spotted upon a white ground, mouth hairy, terminal, 1-sided racemes; one variety with white flowers; fruit 2-celled pyramidal capsule; seeds many, small, brownish-gray. Leaves, more or less crumpled and broken, 10–30 Cm. (4–12′) long, 5–15 Cm. (2–6′) broad, ovate, abruptly contracted into winged petiole, 5–10 Cm. (2–4′) long, or in the smaller leaves nearly absent, crenate, irregular, thin; dull green, wrinkled, sparsely hairy above; pale green, gray, densely pubescent below; venation conspicuously reticulated, midrib and principle veins broad and flat, often purplish, lower veins continued into the wings of the petiole; odor slight, characteristic; taste strongly bitter. Powder, dark green; microscopically—many fragments of non-glandular, 2–8-celled hairs, few glandular hairs with 1–2-celled stalk and head, numerous fragments of lamina with stomata, water-pores, fibro-vascular tissues. Should be kept dark, in tightly-closed containers. *Solvents:* alcohol (65 p. c.); boiling water partially. Dose, gr. 1–2 (.06–.13 Gm.).

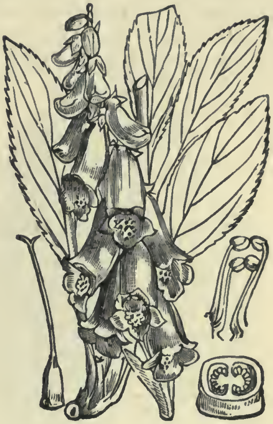


Fig. 362.—*Digitalis purpurea.*

Adulterations.—Leaves: First year's leaves—radical, with very long petioles; also leaves of *D. ambig'ua* (*ochroleu'ca*)—nearly smooth; *Verbascum Thapsus*—yellowish-white, entire, densely long-tomentose, mucilaginous; *Sym'phytum officinale*—entire, scabrous; *Cony'za* (*Inula*) *squarrosa*—scabrous, entire; Powder: Distinguished from all adulterations by the 2–8-celled hairs and absence of calcium oxalate crystals.

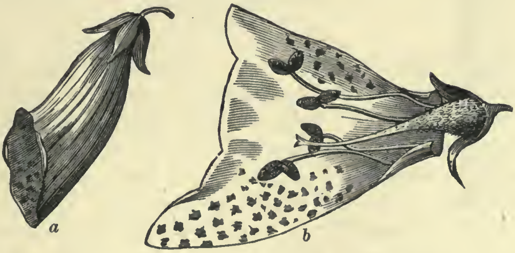


Fig. 363.—*Digitalis purpurea: a,* single flower; *b,* the same opened.

Commercial.—Plant cultivated for ornament and medicine, producing the first year a large fleshy root and a rosette of radical leaves, but no flowering and fruiting stem until the second year. Leaves should be collected from wild plants growing in mountainous regions when two-thirds of the flowers are expanded, July–Sept., from the fact that two series of compounds are formed in plants by the action of light and air: 1, *nutritious,* those for nutrition (constructive metabolism); 2, *secretious,* or secretions of waste products (destructive metabolism). It is only during the flowering stage that every nutritive avenue and substance is taxed and used for flower perfection, thereby leaving elsewhere, as in leaves, etc., the waste products, alkaloids, etc., in a most concentrated form; for the same reason belladonna, hyoscyamus, and many other plants should have leaves (all official parts) gathered when in bloom—the second year of growth, hence the second crop of leaves. Only those full grown and fresh are collected, then carefully and quickly dried without exposure to sun or undue heat, and protected from external moisture, each being placed separate, or in baskets, in dark drying stoves; or the entire plant may be hung up by the roots in a current of warm air, such yielding most digitoxin, that by which the drug's value is determined; carelessness in this process often renders the product inert. When dry should be kept in air-tight, dark containers (or tins, over lime—old Dutch method), and not longer than 1 year if exposed to light and moisture, as quality depends upon color, smell, taste, and yield of digitoxin; seeds are much stronger, keep better, and do not deteriorate upon drying; lose on drying 75 p. c.; cultivated leaves are thicker, deeper color, less hairy, active and acute.

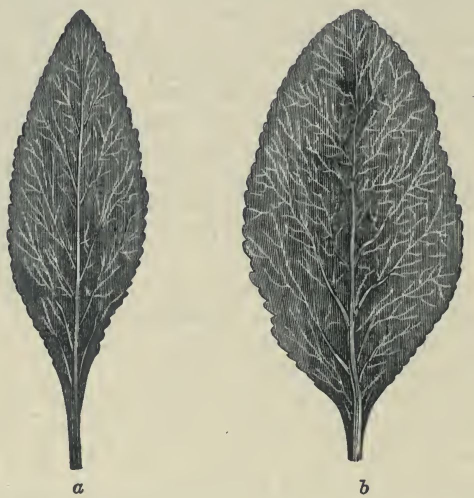


Fig. 364.—Digitalis leaves, upper surface: *a*, of the first year's growth; *b*, of the second year's growth.

Constituents.—Digitoxin, Digitophyllin, Gitalin (digitalein, digalen), gitin, digitsaponin (digitalin + saponin), enzymes, manganese, volatile oil, fixed oil 5 p. c., gum, starch, sugar, chlorophyll, inosit, pectin, coloring matter (red, yellow), digitalosmin, antirrhinic acid, digitalic (malic) acid, ash 15 p. c.

Digitoxin, Digitophyllin, Gitalin (digitalin-group).—Heart stimulant glucosides, the two former soluble in alcohol, the latter also in water, which alone occurs (+ digitsaponin) in the infusion, making it possibly the most important content.

Gitin, Digitsaponin (saponin-group).—Inactive, but presence may increase the activity of the glucosides.

Enzymes (oxydases—only in fresh leaves).—Oxidize or hydrolyze the glucosides (digitoxin, digitophyllin, gitalin) into glucose, digitoxigenin and digitaligenin—all inactive, the associated manganese aiding in the decomposition—this latter being averted only by quickly drying fresh leaves and keeping them dry.

Digitalin, Digitalinum. — This is claimed not to exist as such in the drug, although that name has been given to the once supposed important content, which, in reality, is more or less complex. There are two commercial varieties: 1, *German*, mostly used with us, consisting of digitoxin, digitophyllin, digitalein (heart stimulants), chiefly digitonin (diuretic), digitalin and digitin (inert); yellowish-white amorphous powder, soluble in water, alcohol; 2, *French*—amorphous (yellowish-white, bitter powder), crystalline (needle-shaped crystals, very bitter, insoluble in water—chiefly digitoxin). Digitalin may be obtained by precipitating alcoholic extracts with tannin, washing precipitate, or by heating German variety with alcohol (4) until dissolved, adding ether (5), setting aside, evaporating ether-alcoholic solution, adding water, setting aside to deposit, washing with alcohol. Owing to its varying composition uniform doses, become impossible; usual dose gr. $\frac{1}{60}$–$\frac{1}{30}$ (.001–.002 Gm.); crystalline, dose, gr. $\frac{1}{200}$–$\frac{1}{100}$ (.0003–.0006 Gm.).

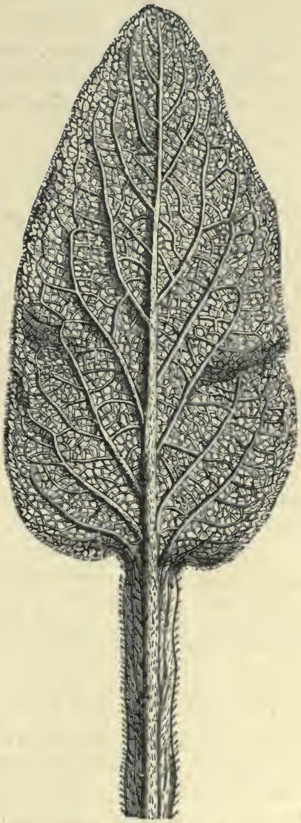


FIG. 365.—Digitalis leaf: under surface.

PREPARATIONS.—1. *Fluidextractum Digitalis.* Fluidextract of Digitalis. (Syn., Fldext. Digital., Fluid Extract of Digitalis; Fr. Extrait fluide de Digitale; Ger. Fingerhutfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: 83 p. c. alcohol. Dose, ♏j–2 (.06–.13 Ml. (Cc.)).

2. *Infusum Digitalis.* Infusion of Digitalis. (Syn., Inf. Digit.; Fr. Tisane de Digitale; Ger. Fingerhutaufguss.)

Manufacture: 1.5 p. c. Macerate for 1 hour 1.5 Gm. with boiling water 50 Ml. (Cc.), strain, add to strained liquid cinnamon water 15 Ml. (Cc.), pass through residue on strainer water q. s. 100 Ml. (Cc.), mix well; must be prepared freshly. Dose, ʒij–4 (8–15 Ml. (Cc.)).

3. *Tinctura Digitalis.* Tincture of Digitalis. (Syn., Tr. Digit.; Fr. Teinture de Digitale; Ger. Fingerhuttinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: 75 p. c. alcohol. Dose, ♏v–30 (.3–2 Ml. (Cc.)).

Unoff. Preps.: Abstract, dose, gr. $\frac{1}{4}$–1 (.016–.06 Gm.). *Extract* (evaporate fluidextract cautiously), dose, gr. $\frac{1}{6}$–$\frac{1}{2}$ (.01–.03 Gm.). *Pilulæ Digitalis, Scillæ et Hydrargyri*—digitalis 6.5 Gm., squill 6.5, mass of mercury 6.5, clarified honey q. s. 100 pills.

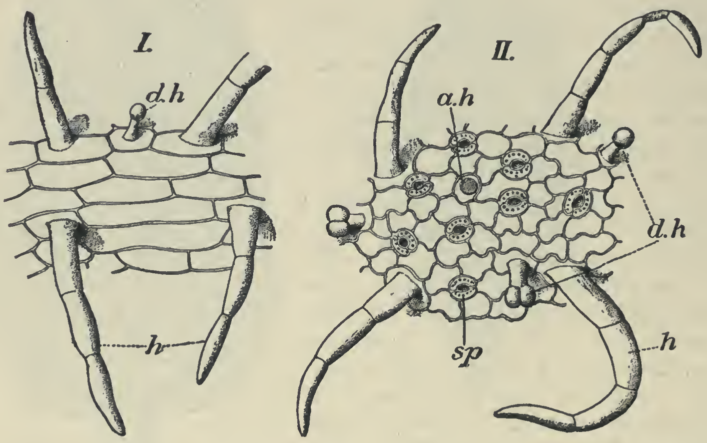


FIG. 366.—Digitalis leaf: *I*, epidermis of upper side seen from above with velvet hairs (*h*) and glandular hairs (*d.h*); *II*, epidermis of under side with stomata (*sp*), velvet hairs (*h*), glandular hairs (*d.h*), and the scar of a broken hair (*a.h*), magnified 175 diam.

While the infusion is the best diuretic, the tincture is the best for heart action; this latter, and the fluidextract, owing to alcohol present, contains most digitoxin and digitophyllin, with little gitalin—some of the digitoxin being precipitated; the extract has also digitoxin, while infusion mostly gitalin and digitsaponin.

PROPERTIES.—Cardiac tonic, vascular stimulant, diuretic, motor-excitant, paralyzant, anaphrodisiac, sedative, narcotic, emetic; normal doses make the pulse slower, firmer, stronger. The diastole (periodic dilatation) is prolonged, owing to stimulation of the pneumogastric; the systole (periodic contraction) is not altered as to duration, but is in degree, the force being increased greatly, owing to stimulation of the heart muscle and its contained ganglia, which may be so powerful as to squeeze out all of the blood, thus causing death in systole by overstimulation. Temperature is lowered by the lessening of blood supply to the tissues. Blood-pressure in the glomeruli of the kidneys is increased, causing diuresis. Recumbent position is best when under its influence. The rapid pulse is due to over-stimulation of the pneumogastric (inhibition) and consequent exhaustion, thus allowing the sympathetic alone to control the action. Digitalis and aconite slow the heart, otherwise are antagonistic; the former increases inhibition, stimulates motor apparatus; the latter does the converse, thus weakening the beat, both finally paralyze cardiac ganglia—digitalis by over-stimulation, aconite by direct depression. Arterial tension is raised by digitalis, lowered by aconite; the latter acts quickly, the former slowly, possessing cumulative action—*i. e.*, several doses given at proper intervals may show no result until suddenly the combined action of all the doses is manifested at once, proving sometimes fatal if not very cautious. In consequence of this, aconite becomes a more valuable antagonist in digitalis-poisoning than digitalis in aconite-poisoning.

Uses.—Where heart is rapid and feeble, deficient and poor circulation (as it causes the heart to expel much more blood than normally), renal disease, venous engorgement, dropsy, pneumonia, scarlet fever, congestive headache, hemicrania in mania, delirium tremens, hemorrhages, menorrhagia, rheumatic fever, spermatorrhœa, pleurisy, pericarditis, chronic bronchitis, epilepsy. Locally to enlarged glands, abdominal and renal dropsy.

Poisoning: Have sneezing, nausea, vomiting of mucus, bile, and dark green matter, colic, purging with severe pain, headache; heart beats violently, but pulse small and shallow, yet upon rising rapid, weak, and irregular; vertigo, yellow vision, face pale, pupils usually dilated, sometimes contracted, eyeballs protruding, sclerotic blue colored, pain in back and limbs, diarrhœa, suppressed urine, salivation, conscious until near the end, delirium, coma, convulsions, death suddenly by paralysis of heart muscle. Wash out stomach with warm water and tannin, give diffusible stimulants (injections), aconitine (best to antagonize large quantities of digitalis), opium (best to antagonize long usage of digitalis), saponin, senegin (best physiological antagonist), Epsom or Rochelle salt, fluidextract of quillaja, and senega, external heat, horizontal position.

Incompatibles: Cinchona, tannin, iron sulphate, lead acetate, tincture of ferric chloride, syrupy and watery solutions, which may decompose drug's active principles.

Synergists: Cardiac stimulants, belladonna, ergot, etc.

Allied Plants:

1. *Veron'ica virgin'ica, Leptandra, Culver's-root* (*-physic*).—The dried rhizome and roots, official 1820–1910; N. America, low grounds. Perennial herb, .6–2 M. (2–6°) high, angular, smooth or downy; leaves lanceolate, serrate, 7.5–10 Cm. (3–4′) long, whorls; flowers, spikes, whitish, tubular, stamens 2, exserted; fruit small, compressed capsule. Rhizome, 4–15 Cm. (1⅗–6′) long, 3–8 Mm. (⅛–⅓′) thick, grayish-

black, bent, branched, cup-shaped scars above, coarse roots or root-scars on sides and beneath, annulate, fracture tough, woody; bark .3–1 Mm. ($\frac{1}{75}$–$\frac{1}{25}'$) thick, wood hard, yellowish, pith large; odor slight; taste bitter, acrid; solvents: 75 p. c. alcohol, water; contains (mostly in bark) leptandrin, resin 6 p. c., tannin, saponin, volatile alkaloid (?). Emeto-cathartic, cholagogue, alterative, tonic; duodenal atony, chronic constipation with insufficiency of biliary and intestinal secretions; acts violently on some persons. Dose, gr. 15–60 (1–4 Gm.); fluidextract (dil. alc.), ♏xv–60 (1–4 Ml. (Cc.))—extract (75 p. c. alcohol), gr. 1–5 (.06–.3 Gm.); tincture, ʒj–2 (4–8 Ml. (Cc.)); leptandrin (similar to podophyllin), gr. 1–5 (.06–.3 Gm.).

2. *V. officina'lis, Common Speedwell;* Europe, N. America.—Procumbent, pubescent, perennial, stem ascending, 7.5–25 Cm. (3–10′) high; leaves obovate, petioled, 2–4 Cm. ($\frac{4}{5}$–$1\frac{3}{5}'$) long, serrate, grayish-green; flowers axillary racemes, wheel-shaped, 4-parted, pale blue corolla with dark blue stripes, 2 exserted stamens; contains bitter principle, tannin; plant used as alterative, diuretic (urinary, calculous disorders), diaphoretic, expectorant (skin diseases, scurvy); in infusion. Dose, gr. 30–60 (2–4 Gm.).

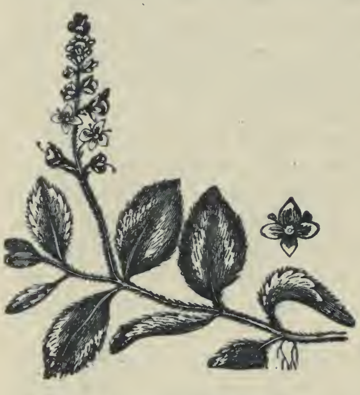


FIG. 367.—*Veronica officinalis:* flowering branch.

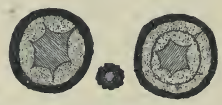


FIG. 368.—*Veronica virginica:* transverse sections of rhizome and root.

3. *Scrophula'ria nodo'sa, Figwort;* N. America.—Perennial plant growing in damp places, 1.2–1.5 M. (4–5°) high, stem obtusely angled, rhizome fleshy, having attached many oval tubers size of the thumb, leaves opposite, serrate; plants bruised when fresh emits an unpleasant, fetid odor; contains scrophularin, scrophularosmin, resin, tannin; alterative, diuretic, anodyne in hepatic affections, scrofula, dropsy, eczema, itch, hemorrhoids, anal ulcers, suppurating sores, etc. Dose, gr. 30–60 (2–4 Gm.).

4. *Chelo'ne gla'bra, Balmony, Snake-head;* United States.—Perennial plant growing in damp places, .6–1 M. (2–3°) high; leaves opposite, oblong-lanceolate, serrate, 7.5–15 Cm. (3–6′) long, flowers white, faintly pink, 2.5 Cm. (1′) long, short, dense, terminal spike; contains bitter principle; tonic, laxative, anthelmintic, jaundice, liver trouble; skin diseases (eczema, etc.) externally. Dose, gr. 30–120 (2–8 Gm.), in decoction.

5. *Verbas'cum Thap'sus, Mullein;* Europe, but naturalized in N. America. Dried leaves (verbasci folia) used. Plant .3–1.3 M. (1–4°)

high, woolly, growing in fields, waste places; flowers yellow, 2.5–4 Cm. (1–1$\frac{3}{5}$′) broad; odor honey-like; taste mucilaginous, sweet; contains volatile oil, mucilage, sugar. Used as a demulcent, pectoral, anodyne, nutritive in consumption, coughs. Dose, gr. 15–60 (1–4 Gm.); fluidextract (dil. alc.); infusion; dried leaves smoked for nasal catarrh. *V. phlomoi'des, V. thapsiforme,* the dried corollas, with adhering stamens (verbasci flores), containing resin, volatile oil, glucoside, gum, coloring, also considerably employed.

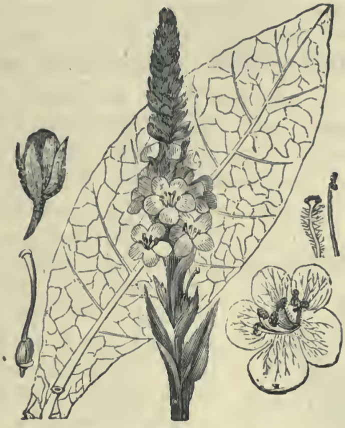


FIG. 369.—*Verbascum Thapsus.*

65. PEDALIACEÆ. Pedalium Family.

Pe-da-li-a'se-e. L. *Pedali-um(on)* + aceæ, fr. Gr. **πηδάλιον,** a rudder—*i. e.,* named in allusion to the dilated angles of the fruit. Herbs, distinguished by being glandular, having oily seeds; leaves entire, exstipulate; flowers large, irregular, calyx 5-cleft, corolla bilabiate, stamens didynamous, anthers 2-celled; ovary on fleshy disk, 1-celled, sometimes 4–6-celled, style 1, stigma divided; fruit drupe or capsule; seeds wingless, exalbuminous; tropics; demulcent.

Genus: **1. Sesamum.**

SESAMUM. BENNE.

Oleum Sesami. Sesame Oil. *official.*

Sesamum indicum, *Linné,* one or more cultivated varieties. } A fixed oil obtained from the seeds.

Habitat. India (Africa, Egypt, Cyprus, Sicily, Turkey, Persia, China, Formosa, Java); cultivated in N. and S. America, S. United States, W. Indies.

Syn. Oily Grain, Oil Plant, Til Seed, Teel; Ol. Sesam., Teel Oil, Benne Oil, Oil of Sesame, Gingili Oil; Fr. Huile de Sésame; Ger. Sesamöl.

Ses'a-mum. L.—Gr. *σήσαμον* fr. Egypt, *sempsen*—*i. e.,* the original plant name.

In'di-cum. L. *indicus,* Gr. Ἰνδικός, pertaining to India—*i. e.,* flourishes natively there.

PLANT.—Annual herb; stem 1–1.3 M. (3–4°) high, branched, quadrangular, striate, somewhat hairy; leaves lanceolate-ovate, lower ones 3-lobed, upper undivided, serrate, slightly pubescent, prominent veins beneath, petiolate; flowers tubular, campanulate, 4 Cm. ($1\frac{3}{5}'$) long, pale purple; fruit capsule, 2.5–5 Cm. (1–2′) long, oblong, quadrangular, falsely 4-celled, pericarp leathery, olive-green, interior yellowish, hairy, dehiscent; seeds 5 Mm. ($\frac{1}{5}'$) long, oblong, triangular, rounded, flattened, testa thick, smooth, variegated color, mostly yellowish.

CONSTITUENTS.—Fixed oil 47–56 p. c., proteids 22 p. c., mucilage 4 p. c., ash 4.8 p. c.

Oleum Sesami. Sesame Oil.—This fixed oil from the seeds is a pale yellow, oily liquid, almost odorless, bland taste, slightly acid, slightly soluble in alcohol, miscible with ether, chloroform, petroleum benzin, carbon disulphide, sp. gr. 0.918; contains triglycerides of oleic (chiefly) and linoleic acids 75 p. c., also myristin, palmitin, stearin 20–25 p. c., sesamin, $C_{11}H_{12}O_3$, crystalline needles, .2–.5 p. c., chloroform solution with sulphuric acid yielding cherry-red or blue acid layer. *Tests:* 1. Shake for half a minute 1 Ml. (Cc.) with a solution of .1 Gm. of sugar in 10 Ml. (Cc.) of hydrochloric acid—acid layer bright red, changing to dark red on standing. 2. Mix 5 Ml. (Cc.) with 5 Ml. (Cc.) of a mixture of equal vols. of amyl alcohol and a 1 p. c. solution of sulphur in carbon disulphide, immerse test-tube to one-third depth in boiling saturated aqueous solution of sodium chloride—no reddish color in 15 minutes (abs. of cottonseed oil). Should be kept in well-closed containers. Dose, ℥ss–2 (15–60 Ml. (Cc.)).

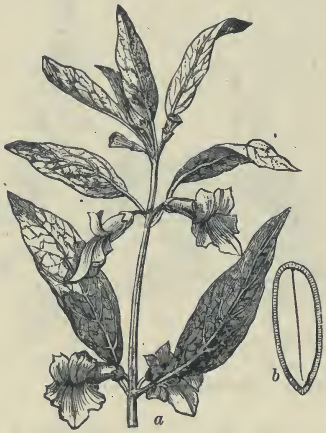


FIG. 370.—*Sesamum indicum: a*, flowering branch; *b*, section of seed enlarged.

Commercial.—Plant cultivated early in Asia, Africa by Persians, Arabs, Egyptians, and from this latter country supposed to have reached the United States in African slave traffic. Seeds are used natively as food (parched) in broths, puddings, bread, etc. Oil usually extracted by expression, but can be by decoction and solution.

PREPARATION.—1. *Linimentum Ammoniæ*, 75 p. c.

Unoff. Preps.: Olea Infusa, 80 p. c.

PROPERTIES.—Laxative, demulcent, emollient, nutritious.

USES.—Similar to olive oil, but less agreeable and digestible; mostly externally in hair preparations, as a substitute for olive oil; internally in emulsion. Leaves, official 1830–1880; abound in mucilage (gum), extracted by soaking in cold water and forming a bland demulcent drink in diarrhœa, dysentery, cholera infantum, acute cystitis, strangury, etc. Seeds often used by Southern negroes, as by natives, being beaten up for food or poultice, or made into infusion as abortive, emmenagogue.

Allied Products:

1. *Ground-nut Oil, Pea-nut Oil* (*Ar'achis hypogæ'a*).—Tropical America; seeds contain fixed oil 45 p. c.; used instead of sesame and olive oil. 2. *Soy Oil* (*Glyci'ne* (*So'ja*) *his'pida*), Japan; seeds reniform, used as food and for making a sauce (soy); contain bland fixed oil 15–20 p. c. 2. *Ben Oil, Behen Oil* (*Morin'ga ap'tera, M. pterygosper'ma*), E. India; seeds called *ben-nuts*, have elongated, membranous wings; yield fixed oil 30 p. c.; used as purgative and in extracting perfume from flowers.

66. RUBIACEÆ. Madder Family.

Ru-bi-a'se-e. L. *Rubi-a* + aceæ, madder, fr. *rubeus, rubere*, red—*i. e.*, referring to color of the roots. Trees, shrubs, herbs. Distinguished by versatility of important uses; stems round or angular; leaves opposite, stipulate, calyx 4–5-toothed, superior; corolla 4–5, regular, epigynous; stamens 4–5, on corolla-tube, anthers 2-celled; ovary inferior, 2–4-celled; fruit inferior, dry or succulent, edible, 2-celled; seeds 1 or more in each cell; temperate climates, tropics; tonic, febrifuge, astringent, emetic, purgative, diuretic, emmenagogue, dyeing, tanning, poisonous.

Genera: **1. Coffea. 2. Cephaëlis. 3. Cinchona. 4. Ourouparia.**

CAFFEA. COFFEE.

Caffeina. **Caffeine,** $C_8H_{10}N_4O_2 + H_2O$, *official.*

Coffea arabica, *Linné,*
and
Thea sinensis, *Linné.*

A feebly basic substance (alkaloid) from the seeds of the former and leaves of the latter (Theaceæ), also occurring in other plants; or prepared synthetically. See page 402.

Habitat. 1. Tropical Africa (Arabia, Abyssinia, Ceylon, Mocha); cultivated in tropical countries (Java, W. Indies, S. America—Brazil (most), Guatemala (best), etc.). 2. S. E. Asia (upper Assam, China, Japan, Java, S. United States); cultivated.

Syn. Semen Coffea; Fr. Café; Ger. Kaffee (bohnen), Caffeia; Caffein, Theine, Guaranine, Trimethylxanthine, Methyltheobromine; Fr. Caféine, Théine; Ger. Coffeïnum, Koffein, Kaffeïn, Thein.

Cof'fe-a. L. for coffee, after Coffee, a province of Narea, in Africa, where it grows abundantly; Arabic name of the decoction—*chaubé, cavé, cahua, caova.*

A-rab'i-ca. L. Arabian—*i. e.*, its chief habitat.

Plant.—Handsome shrub or small tree 3–4.5 M. (10–15°) high, by cultivation trimmed down to 1.5–2 M. (5–6°); bark smooth, gray; leaves 10–15 Cm. (4–6′) long; 2.5–5 Cm. (1–2′) wide, ovate, alternate, coriaceous, glossy, entire; flowers small, fragrant, white, funnel-shape, cymes; fruit oval, 12 Mm. (½′) long, scarlet, but purple when ripe, 2-celled, 2-seeded drupe, each seed in a parchment-like endocarp; pericarp with scanty, scarcely succulent pulp, dehiscent; seed large, solitary in each cell, rounded back, flat on ventral surface (by which they face each other), hard, bony, grayish, deep narrow fissure in centre.

Adulterations.—Seed: Inferior grades: natural discolored (yellow and brown grain); artificial colored (Prussian blue, indigo, sugar, egg-albumen)—removed by soaking in water; factitious coffee made of clay, kaolin, evaporated skimmed milk, etc.—have little taste and no groove on flat side. Ground coffee: Sometimes roasted dandelion, chicory, amylaceous roots, corn, peas, beans, acorns, wheat, rye, sweet potatoes, coffee extract, etc.

Constituents.—Caffeine 1–2.3 p. c., caffearine fat (olein, palmitin) 13 p. c., glucose, dextrin 15 p. c., proteids 13 p. c., caffeo-tannic acid, (chlorogenic, coffalic), volatile oil, citric acid, trigonelline, pectin, oxydase, moisture 12–15 p. c., ash 3–5 p. c., mocha 7–8 p. c.—K, Na, Mg, carbonates, phosphates.

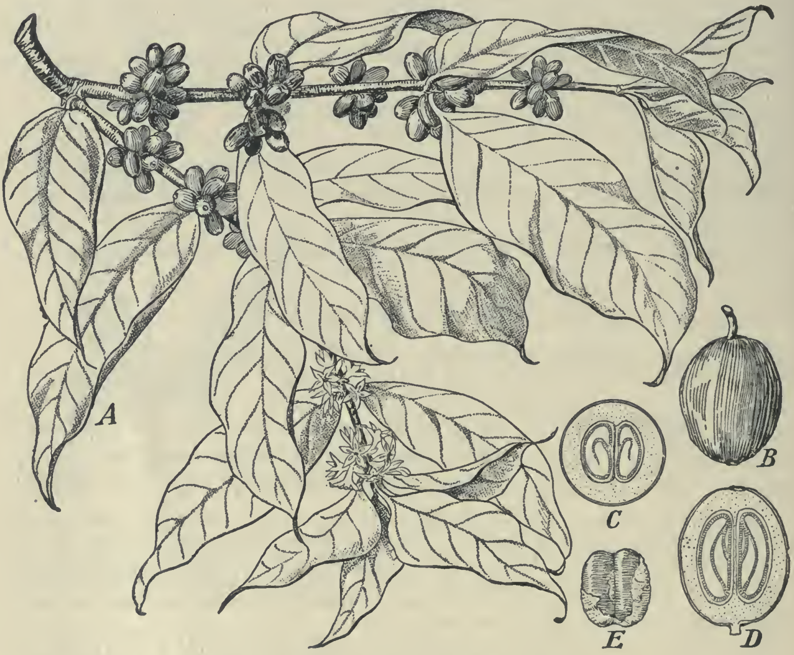


Fig. 371.—*Coffea arabica: A*, blooming and fruiting twig; *B*, fruit; *C*, fruit, cross-section; *D*, fruit, longitudinal section; *E*, seed still partly enclosed in the parchment-like endocarp.

Caffeina. Caffeine.—This is prepared commercially almost exclusively from tea and tea-dust or sweepings, but can be obtained from a strong infusion of tea or unroasted coffee by adding lead acetate to precipitate tannin, coloring matter, etc., filtering, removing excess of lead by hydrogen sulphide, concentrating, crystallizing. It is in white, flexible, silky, glistening needles, usually matted together in fleecy masses, odorless, bitter, efflorescent, soluble in water (46), hot water (5.5), alcohol (66), chloroform (5.5), ether (530); saturated aqueous solution neutral, melts, when anhydrous, at 236° C. (457° F.). *Tests:* 1. Dissolve .01 Gm. in hydrochloric acid 1 Ml. (Cc.), add potassium chlorate .1 Gm., evaporate to dryness, invert the container over a vessel containing a few drops of ammonia water—residue purple, destroyed by fixed alkalies. 2. Aqueous solution + tannic acid T. S. —precipitate, soluble in excess of reagent. 3. Dry to constant weight —loses 9 p. c.; incinerate 2 Gm.—ash .05 p. c. *Impurities:* Alkaloids, organic substances. Dose, gr. 1–5 (.06–.3 Gm.).

Commercial.—Tree resembles our cherry, although more delicate, grows in clusters in hilly woods, 300–600 M. (1.000–2.000°) elevation; first known in Europe, 1652, as coming from Arabia, Abyssinia, where it was popular in the 15th century. The Dutch first grew it in Europe, 1690, and introduced it into America at Surinam, 1718, Cayenne, W. Indies, 1725. There are four varieties: 1, *Mocha,* best, smallest, dark yellow, growing on the Arabian hills around Mocha; 2, *Java* (*E. Indian, Ceylon*), largest, pale yellow; 3, *Rio, Brazilian* (*W. Indian, Demerara*), intermediate size, bluish or greenish-gray; 4, *Liberian* (*C. liberica*—most hardy and resistant to diseases), larger berries, finer flavor. The seeds are separated from papery endocarp by drying, passing between wooden rollers, and through a winnowing mill. In roasting at 250° C. (482° F.), the fat, sugar, and tannin are destroyed, some caffeine volatilized, and an empyreumatic volatile oil (caffeol, coffeone), or some other active principle, volatile or otherwise, is developed—losing 8 p. c. water, 9 p. c. organic matter, becoming pulverizable, more aromatic, and more soluble in water. Much care should be exercised in this process to use closed vessels and not too great heat. Caffeine exists in all plants as a complex tannoid, and as such possesses decided but different physiological activity from the free alkaloid.

PREPARATIONS.—1. *Caffeina Citrata.* Citrated Caffeine. (Syn., Caffein. Cit.; Br. Caffeinæ Citras, Caffeine Citrate; Fr. Citrate de Caféine; Ger. Koffeincitrat.)

Manufacture: Dissolve citric acid 50 Gm. in hot distilled water 100 Ml. (Cc.), add caffeine 50 Gm., evaporate to dryness on water-bath, constantly stirring toward the end, reduce to fine powder. It is a white powder, odorless, slightly bitter, acid taste and reaction; forms clear syrupy solution with small quantity of water, but caffeine precipitates on dilution, being redissolved by additional water; compound unstable, contains 48 p. c. of anhydrous caffeine. *Tests:* 1. Mix 2 Ml. (Cc.) of aqueous solution (1 in 10) with lime water (50)—clear in the cold, but turbid upon boiling. 2. Dry to constant weight—loses 5 p. c.; incinerate 1 Gm.—ash .1 p. c. *Impurities:* Heavy metals, tartaric acid, sulphuric acid. Should be kept in well-closed containers. Dose, gr. 2–10 (.13–.6 Gm.).

Prep.: 1. *Caffeina Citrata Effervescens.* Effervescent Citrated Caffeine. (Syn., Caff. Cit. Eff.; Br. Caffeinæ Citras Effervescens, Effervescent Caffeine Citrate; Fr. Citrate de Caféine Effervescent; Ger. Brausendes Koffeincitrat.)

Manufacture: Mix powdered citric acid 19.5 Gm. with citrated caffeine 4, tartaric acid 30, incorporate sodium bicarbonate 57; heat in an oven to 93–104° C. (199–219° F.), and when by careful manipulation with a wooden spatula the mixture is moist, rub through a No. 6 tinned-iron sieve, dry granules at 54° C. (129° F.); contains 1.9 p. c. of anhydrous caffeine. Should be kept dry, in tightly-sealed containers. Dose, ʒj–2 (4–8 Gm.).

2. *Caffeinæ Sodio-Benzoas.* Caffeine Sodio-Benzoate. (Syn., Caff. Sod. Benz.; Fr. Soude benzoate de Caféine; Ger. Caffeino-natrium Benzoicum, Koffein-natriumbenzoat.)

Manufacture: Mix caffeine and sodium benzoate each 50 Gm., rub to smooth paste with alcohol q. s., dry in moderately warm place. It is a white powder, odorless, bitter, soluble in water (1.1), some caffeine separating on standing, alcohol (30), partly in chloroform; aqueous solution (1 in 20) neutral, slightly acid or alkaline, not reddened by phenolphthalein T. S.; contains 46–50 p. c. of anhydrous caffeine, $C_8H_{10}N_4O_2$, the remainder being sodium benzoate, $NaC_7H_5O_2$. *Tests:* 1. Heat—decomposes with evolution of white vapors, carbonaceous residue effervesces with acids and colors flame yellow. 2. Aqueous solution + ferric chloride T. S.—salmon-colored precipitate; + diluted hydrochloric acid—white precipitate (benzoic acid). 3. Dry to constant weight—loses 5 p. c. *Impurities:* Heavy metals, readily carbonizable organic matter. Should be kept in well-closed containers. Dose, gr. 2–10 (.13–.6 Gm.), in powder, capsule, effervescent draught, hypodermically (?).

Unoff. Preps.: Coffea Tosta (Roasted), containing caffeine, 1 p. c., fat, 10 p. c. *Fluidextract* (glycerin 6.5, alcohol 25, water 68.5). *Caffeine Sodio-Salicylate,* caffeine, sodium salicylate, each 50, dose, gr. 2–10 (.13–.6 Gm.).

PROPERTIES.—Tonic, stimulant, nervine, antiemetic, caffeine in small doses stimulates appetite, digestion, secretion of bile, quickens heart action, respiration, increases arterial tension, urine; normal doses, cerebral stimulant, causing nervous restlessness, wakefulness, increased mental activity. Large doses (gr. 5–10; .3–.6 Gm.) produce heaviness of head, insomnia, delirium, rapid, feeble pulse, cold extremities, elevated temperature, convulsions, paralyzes cardiac muscle, but death occurs from paralysis of respiration; valuable as a hydragogue diuretic; ordinary salts not suitable for hypodermic use as they decompose by the presence of water. Caffeine sodio-benzoate as a cerebral and cardiac stimulant has the advantage of being moderately stable and non-irritating. Coffee is laxative, diuretic, antiperiodic, antiseptic. Used mostly, however, as a beverage, for which alone about 1,500,000,000 pounds (680,272,110 Kg.) are consumed annually, making 1 pound (.46 Kg.) to every living person; in the United States about 6–7 pounds (2.7–3 Kg.) per capita, in Holland 10 pounds (4.6 Kg.).

USES.—Caffeine in neuralgia or nervous headaches, diarrhœa of cholera, phthisis, cardiac and renal dropsies, lithæmia, gout, insomnia of chronic alcoholism, adynamic fevers. Coffee in intermittents, asthma paroxysms, opium narcosis, to antagonize general torpor of nervous centres.

Allied Plants:

1. In addition to the official source, *Coffea arabica*, there are a number of species that furnish coffee, as *C. mauritia'na*, of Mauritus, *C. zanguebar'ia*, of Zanzibar, Mozambique, etc., and *C. liber'ica*, of Liberia, this last being by far the most important of the three.

2. *Co'la acumina'ta, Cola Nut.*—Sterculiaceæ. W. Africa (see page 400); seeds contain caffeine 2 p. c., theobromine, tannin, volatile oil, etc.

3. *Paullin'ia Cupa'na, Guarana.*—Sapindaceæ. Brazil (see page 382); seeds contain caffeine (guaranine) 4–5 p. c., tannin 2.6 p. c., starch, mucilage, fat, saponin, resin, volatile oil.

IPECACUANHA. IPECAC.

Cephaëlis {
Ipecacuanha,
(Brotero) A. Richard,
acuminata,
Karsten.
} { The dried root, with not more than 5 p. c. of stems, foreign matter, containing 1.75 p. c. of ether-soluble alkaloids.

Habitat. Brazil to Bolivia, Columbia, damp forests; cultivated in India.

Syn. Hippo, Poaya; Br. Ipecacuanhæ Radix; Fr. Ipécacuanha annelé (officinale), Racine brésilienne; Ger. Brechwurzel, Ruhrwurzel.

Ceph-a-ë'lis. L. fr. Gr. κεφαλή, a head, + ἔιλω, to collect—*i. e.*, flowers collected into a capitulum.

Ip-e-cac-u-an'ha. L. fr. Braz. Indian name *ipecaaguen*, which means "smaller roadside sickmaking plant."

A-cu-mi-na'ta. L. *acuminatus*, pointed, acute—*i. e.*, apex of the leaves.

Ip'e-cac. An abbreviation of ipecacuanha.

Plants.—Shrubby perennials; stem .3–.5 M. (12–18′) high, with often .3 M. (12′) additional underground, decumbent or erect, woody, knotted with leaf-scars, smooth and gray at the base, quadrangular, pubescent and green above, simple or branched; leaves few, 6–8, somewhat crowded at the top, 7.5–10 Cm. (3–4′) long, 2.5–5 Cm. (1–2′) broad, stipulate, opposite, petiolate, obovate, entire, wavy margins, dark green, smooth above, paler, pubescent, prominent veined beneath; flowers Jan.–Feb., small white dense heads, 8–20 together, funnel-shape, hairy; fruit May, in clusters of dark purple berries 12 Mm. ($\frac{1}{2}'$) long, each with 2 small, plano-convex, stony seeds. Root (*C. Ipecacuanha*): *Rio*, in cylindrical, curved, sharply flexuous, pieces, occasionally branched, 3–15 Cm. ($1\frac{1}{5}$–$6'$) long, 2.5–4 Mm. ($\frac{1}{10}$–$\frac{1}{6}'$) thick, grayish-black, closely annulated with thickened, incomplete rings, usually transverse fissures with vertical sides; bark thick, easily separable from yellowish-white wood; fracture of bark short, of wood tough; stems cylindrical, 5–10 Cm. (2–4′) long, 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}'$) thick, finely longitudinally wrinkled, few elliptical scars; (*C. acuminata*): *Carthagena*, cylindrical, slenderly fusiform, tortuous, 3–12 Cm. ($1\frac{1}{5}$–$5'$) long, 4–6.5 Mm. ($\frac{1}{6}$–$\frac{1}{4}'$) thick, grayish-black, fewer annulations and transverse fissures, circular root-scars; bark 2 Mm. ($\frac{1}{12}'$) thick, smooth, horny, easily separable from light brown wood; stems one-third thicker, somewhat zigzag, bark thin; odor slight, distinctive, dust sternutatory; taste bitter, nauseous, acrid. POWDER, light brown; microscopically—numerous starch grains, .003–.017 Mm. ($\frac{1}{8325}$–$\frac{1}{1475}'$) broad, few calcium oxalate raphides, tracheids, few stone cells (stem bark). Should be kept cool, dry. *Solvents:* alcohol; water (injured by boiling). Dose, emetic, gr. 20 (1.3 Gm.), or gr. 5–10 (.3–.6 Gm.), repeated in 10-minute intervals, each followed by hot chamomile tea; nauseant, diaphoretic, expectorant, gr. 1–2 (.06–.13 Gm.).

ADULTERATIONS.—ROOT: Roots of allied species—striated, undulated (most important), *Cephaëlis tomento'sa,* excessive portion of non-annulated woody stem; roots of *Trios'teum perfolia'tum* and *Heterop'teris pauciflo'ra,* both resembling somewhat the official, the latter containing an inulin-like body instead of starch; Johore and Matto Grosso ipecac—larger, but annulations not so deep as the official. POWDER: Starches, flour, almond-meal, etc., all being recognized easily under the microscope—the first two by the shape of granules, the last by scurvy testa, oil-cells, and yielding hydrocyanic acid when infused with water; ground olive stones 3–40 p. c.

Commercial.—Sound ipecac in quality is proportionate to the thickness of the bark (75–90 p. c.), and the thinness of the wood (10–25 p. c.), as most of the alkaloids reside in the former; that with very thick bark is designated as "bold" (fancy), that with thick woody centre as "wiry;" the stem portion should not indicate having been leaf-bearing, as such parts exposed to light and air are always weaker in alkaloids. Ipecac was known first in Europe, 1762, as about this time Helvetius, a Dutch physician, became celebrated in Paris from its secret use; it was, however, in 1688, purchased from him by Louis XIV. for 1,000 louis d'or ($4,600). It grows in rich loam of hot, moist forests, under trees in bunches, presenting two varieties according to its woody or herbaceous stems, the latter usually prostrate and covered with vegetable débris, otherwise exactly alike. This growth-habit produces a great distinction between the upper and lower stem-portions, causing the latter to be collected often with the root, when the product is termed "stemmy." The color of the roots of either kind is not uniform, both furnishing *brown, red,* and *gray,* which difference is only superficial, depending solely upon season of year collected, age, soil, climate, and mode of curing; the brown is least bitter and most abundant with us; the gray is most bitter and the larger. The root is collected at any time when the ground is soft (mainly Jan.–March), except in rainy weather, as then cannot dry properly, by *poayeros* (collectors, fr. *poaya,* Braz. name of the plant), who catch the stem, pull it backward as far as possible, and thrust deep into the ground a stick with broad, sharp end, thus cutting the ramifications, but leaving sufficient roots to produce, from adventitious buds, new plants the following year. The plant-juice is so irritating as to produce sores upon the hands and elsewhere, consequently collectors only accept such labor in the absence of rubber-gathering, and that otherwise more congenial, thus accounting largely for the drug's high price. Roots are freed from adhering earth by shaking, put into bags, at night assorted, next day spread in the sun and carefully dried 3–4 days, being protected at night from heavy dews, then broken into small pieces, separated from any remaining earthy particles by sieves, and packed tightly in bags or hide-bound bales (seroons), which are stored carelessly awaiting sale—a condition, along with the incident exposure to damp weather and river-water in shipment, that renders three-fourths of the output considerably damaged by moldiness. There are two varieties: 1, *Rio, Brazilian, Para* (*C. Ipecacuanha*), distributed widely through Brazil, Bolivia, being collected chiefly in proximity to the Itenez River, and exported via Rio Janeiro or Para; 2, *Carthagena, Columbian* (*C. acuminata*), grown wild mostly in Columbia, being exported chiefly via Carthagena; contains an equal amount of total alkaloids, but more cephaëline and less emetine than Rio.

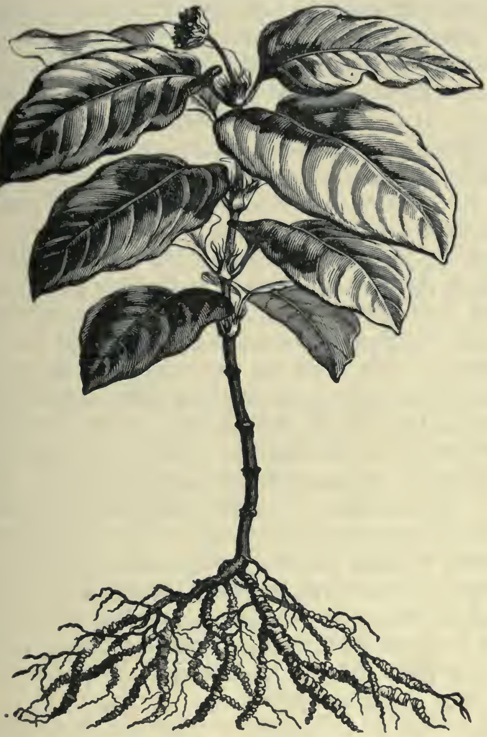


FIG. 372.—*Cephaëlis Ipecacuanha.*

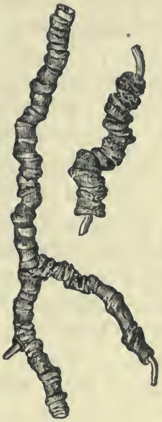


FIG. 373.—Ipecac root; normal size.

CONSTITUENTS.—Alkaloids 2.28–3.36 p. c.: Emetine 2–3.14 p. c., Cephaëline .6 p. c., psychotrine, ipecacuanhic acid (ipecacuanhin)

2.25 p. c., Kryptonine, $C_{29}H_{40}N_2O_9$ (colloidal), choline, resin, starch 40 p. c., wax, fat, volatile oil, erythrocephaëlin (coloring matter—deep purple with alkalies), saccharose, ash 1.8–4.5 p. c.

Emetine (Methyl-cephaëline), $C_{15}H_{22}NO_2$.—Obtained by adding basic lead acetate to alcoholic tincture, filtering, removing excess of lead with diluted sulphuric acid, neutralizing filtrate, distilling off alcohol, shaking out clear residual liquid with ether and ammonia, shaking out ether solution with weak sulphuric acid, and shaking repeatedly this acidulated solution with sodium hydroxide, in the presence of ether, until cephaëline (base soluble in caustic alkali) is separated completely; emetine (base insoluble in caustic alkali) is converted into hydrochloride, recrystallized from water, and finally precipitated with ammonia. It is amorphous, white, becoming yellow by exposure, soluble in alcohol, ether, benzene, chloroform; forms salts, most of which are crystalline. Dose, expectorant, gr. $\frac{1}{200}$–$\frac{1}{60}$ (.0005–.001 Gm.); emetic, gr. $\frac{1}{16}$–$\frac{1}{4}$ (.004–.016 Gm.). Poisonous in large quantities; impure emetine is 10 times weaker.

Emetinæ Hydrochloridum, Emetine Hydrochloride, $C_{30}H_{44}N_2O_4.2HCl$, *official.*—(Syn., Emet. Hydrochl.; Fr. Chlorhydrate de Emetine; Ger. Emetinhydrochlorid, Salzsaures Emetin.) This hydrochloride of the alkaloid is obtained by dissolving emetine in diluted hydrochloric acid, allowing to crystallize. It is a white, very slightly yellowish crystalline, odorless powder, darker on exposure to light, soluble in water, alcohol; aqueous solution (1 in 20) slightly acid; contains variable amounts of water of crystallization. *Tests:* 1. Aqueous solution (1 in 100), + iodine T. S., mercuric potassium iodide T. S., or platinic chloride T. S.—precipitates. 2. With sulphuric acid containing in each Ml. (Cc.) about .005 Gm. of molybdic acid—bright green. 3. Aqueous solution, + silver nitrate T. S.—white precipitate, insoluble in nitric acid; dry at constant weight—loses 19 p. c.; incinerate .2 Gm.—ash non-weighable. *Impurities:* Cephaëline, readily carbonizable substances. Should be kept dark, in dark amber-colored vials. Dose, expectorant, gr. $\frac{1}{12}$–$\frac{1}{6}$ (.005–.01 Gm.); emetic, gr. $\frac{1}{6}$–$\frac{1}{3}$ (.01–.02 Gm.).

Cephaëline, $C_{14}H_{20}NO_2$.—This is 2–5 times stronger than emetine, the two representing the drug's activity, and relative proportion varying; it is crystalline, white, becoming yellow by exposure, distinguished from emetine by its solubility in caustic alkalies and by being less soluble in ether; forms uncrystallizable salts. Dose, same as emetine.

Psychotrine.—This exists in ipecacuanha in small amount compared with two preceding alkaloids, and unlike them is only slightly soluble in ether; obtained by extracting with chloroform the ammoniacal liquid, from which emetine and cephaëline have been separated by ether; occurs in crystals which separate from ether in lemon-yellow transparent prisms, melts at 138° C. (281° F.), soluble in alcohol, chloroform.

Ipecacuanhic Acid (Cephaëlic Acid), $C_{14}H_{18}O_7$.—An amorphous, bitter glucoside, once believed identical with gallic acid, but more closely resembles caffeo-tannic acid; obtained by precipitating decoction with lead acetate, dissolving precipitate in acetic acid, then precipitating with lead subacetate; it is bitter, amorphous, brown, soluble in alcohol, green with ferric salts.

Preparations.—1. *Fluidextractum Ipecacuanhæ.* Fluidextract of Ipecac. (Syn., Fldext. Ipecac., Fluid Extract of Ipecac; Br. Extractum Ipecacuanhæ Liquidum; Fr. Extrait fluide d'Ipécacuanha; Ger. Ipecacuanhafluidextrakt.)

Manufacture: Similar to Fluidextractum Ergotæ, page 60; 1st menstruum: alcohol 20 Ml. (Cc.), water 20, diluted hydrochloric acid 10; 2nd menstruum: 40 p. c. alcohol; reserve first 80 Ml. (Cc.), in which dissolve soft extract, assay and add enough 2nd menstruum for the 100 Ml. (Cc.) to contain 1.8–2.2—2 Gm. of ether-soluble alkaloids. Dose, ♏j–20 (.06–1.3 Ml. (Cc.)).

Prep.: 1. *Syrupus Ipecacuanhæ.* Syrup of Ipecac. (Syn., Syr. Ipecac.; Fr. Sirop d'Ipécacuanha; Ger. Brechwurzelsirup, Ipecacuanhasirup.)

Manufacture: 7 p. c. Mix, by thoroughly shaking, fluidextract of ipecac 7 Ml. (Cc.), water 30 Ml. (Cc.), acetic acid 1 Ml. (Cc.), set aside for 24 hours, filter, pass through filter water q. s. 45 Ml. (Cc.), add glycerin 10 Ml. (Cc.), sugar 70 Gm., water q. s. 100 Ml. (Cc.), mix thoroughly, strain. Dose, expectorant, ♏v–15 (.3–1 Ml. (Cc.)); emetic, ʒss–4 (2–15 Ml. (Cc.)).

2. *Pulvis Ipecacuanhæ et Opii.* Powder of Ipecac and Opium. (Syn., Pulv. Ipecac. et Opii., Compound Powder of Ipecac, Dover's Powder; Br. Pulvis Ipecacuanhæ Compositus; Fr. Poudre d'Ipécacuanha opiacée—de Dover; Ger. Pulvis Ipecacuanhæ opiatus, Doversches Pulver, Pulvis Doveri.)

Manufacture: 10 p. c. Triturate together ipecac 10 Gm., powdered opium 10 Gm., sugar of milk 80 Gm.; reduce to fine uniform powder. It is grayish-white, light brown; microscopically—angular, cone-shaped fragments, slowly soluble in water or hydrated chloral T. S., strongly polarizing light with display of colors (sugar of milk), few tracheids, numerous starch grains of ipecac, .003–.017 Mm. ($\frac{1}{8325}$–$\frac{1}{1475}$′) broad, few stone cells of opium (poppy) capsules. Dose, gr. 5–10 (.3–.6 Gm.).

Unoff. Preps.: Decoction, Infusion, each 5 p. c., dose, ℥ss–1 (15–30 Ml. (Cc.)). *Extract,* dose, gr. $\frac{1}{20}$–$\frac{1}{2}$ (.003–.03 Gm.). *Pilulæ Antidyspepticæ,* $\frac{1}{10}$ gr. (.006 Gm.). *Pilulæ Laxativæ Compositæ,* $\frac{1}{16}$ gr. (.004 Gm.). *Pilulæ Laxativæ Post Partum,* $\frac{1}{13}$ gr. (.005 Gm.). *Pilula Ipecacuanhæ cum Scilla* (Br.)—ipecac 6, opium 6, potassium sulphate 48, squill 20, ammoniacum 20, syrup of glucose q. s. for mass, dose, gr. 4–8 (.26–.5 Gm.). *Syrup of Ipecac and Opium,* tinct. ipecac and opium 8.5 p. c., spirit of cinnamon .4, cinnamon water 3.2, syrup q. s. 100. *Tincture,* 10 p. c. *Tincture of Ipecac and Opium,* each 10 p. c. (+ dil. alc.), dose, ♏v–20 (.3–1.3 Ml. (Cc.)). *Wine,* 10 p. c., dose, ♏j–60 (.06–4 Ml. (Cc.)). *Troches,* each $\frac{1}{3}$ gr. (.02 Gm.).

Properties.—Emetic, nauseant, expectorant, diaphoretic, sternutatory (cholagogue, antiseptic, hæmostatic, counter-irritant). Small doses (gr. $\frac{1}{8}$–$\frac{1}{4}$; .008–.016 Gm.), stomachic, tonic, large doses (gr. 5–20; .3–1.3 Gm.), emetic in 30 minutes, not violent nor depressing; if doses repeated, have tolerance, catharsis; may cause irritation, hemorrhage. Emetine kills animals by cardiac paralysis. Vomiting due to local irritation of the stomach and a direct action upon vomiting centre in the medulla; it increases, by stimulation, the secretion of bile, bronchial and intestinal mucus.

Uses.—Acute indigestion, nauseating bilious headache, small doses for bronchitis, whooping-cough, asthmatic catarrh, spasmodic croup (here syrup given until vomiting occurs), spasmodic asthma, pneumonia, rigidity of os uteri, hæmoptysis, hemorrhage, atonic dyspepsia, vomiting in pregnancy (hourly ♏j; .06 Ml. (Cc.) of wine), catarrhal jaundice (gr. 20; 1.3 Gm. daily), pyorrhœa (fldext., alcresta), chronic dysentery, diarrhœa, hectic sweats, cholera, cholera morbus, remittent fever, urticaria, cases of poisoning; locally in ophthalmia (decoction). As diaphoretic and expectorant give at long intervals; the syrup always to infants. Its action is somewhat irregular, gr. 5 (.3 Gm.) sometimes being as effective as gr. 15 (1 Gm.). Emetine gr. $\frac{1}{10}$ (.006 Gm.) has induced vomiting, while gr. 12 (.8 Gm.) given in 24 hours have caused no unpleasant symptoms.

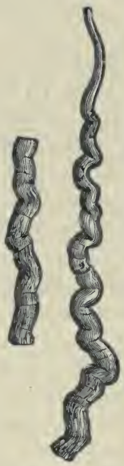


Fig. 374.—Undulated ipecacuanha.

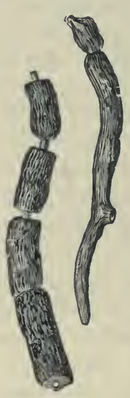


Fig. 375.—Striated ipecacuanha.

Poisoning: Usually have severe vomiting of stomach contents, mucus, blood, etc. Unless thoroughly vomited, wash out stomach with tannin solution, if necessary follow with opium, belladonna, cardiac stimulants.

Incompatibles: Lead and mercury salts, vegetable acids, astringent infusions, bismuth compounds, phenol and hydrocyanic acid.

Synergists: Emetics, sedative expectorants, warm drinks.

Allied Plants:

1. *Psycho'tria emet'ica, Striated Ipecac.*—Root 6 Mm. ($\frac{1}{4}'$) thick, longitudinally wrinkled, not annulate, transverse fissures through bark, purplish-brown; bark thick; contains little emetine, much sugar, no starch. There is a small striated ipecac (a species of *Richar'd(so'n)ia*) 3 Mm. ($\frac{1}{8}'$) thick, otherwise same as the ordinary striated.

2. *Richar'd(so'n)ia sca'bra, Undulated (Farinaceous) Ipecac.*—Undulate wrinkled; annulate, transversely fissured, brownish-gray; bark white, mealy, not bitter, wood nearly as thick as the bark.

3. *Calceola'ria (Ionid'ium) Ipecacuanha, White Ipecac.*—Violaceæ. Branched, not annulate, longitudinally wrinkled, whitish-yellow; wood porous, thick, yellowish, no starch.

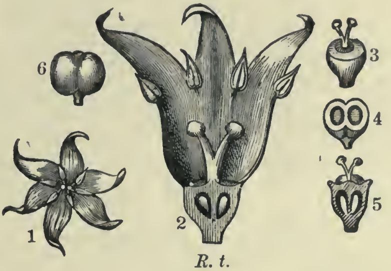


FIG. 376.—*Rubia tinctorum: 1*, open flower; *2*, longitudinal section of flower enlarged; *3*, ovary; *4*, cross-section of ovary; *5*, longitudinal section of ovary; *6*, fruit.

4. *Ascle'pias curassav'ica, Bastard Ipecac.*—C. and S. America has short rootstock abruptly divided into many yellowish rootlets.

5. *Ru'bia tincto'rum, Madder.*—The root, official 1820–1880; S. Europe, Asia. Perennial herb, square stem, covered with short prickles by which it climbs; leaves elliptical, 7.5 Cm. (3′) long; flowers yellow; root creeping, 5 Mm. ($\frac{1}{5}'$) thick, reddish, sweetish, bitter, acrid, astringent taste; contains rubian (yellow), alizarin (orange-red), ruberythrin (yellow needles, blood-red with alkalies), purpurin. Used as tonic, diuretic, emmenagogue; dropsy, amenorrhœa, rachitis, dyeing. Dose, gr. 15–60 (1–4 Gm.).

CINCHONA. CINCHONA.

1. CINCHONA. Cinchona.
2. CINCHONA RUBRA. Red Cinchona.

Cinchona	**Ledgeriana,** + hybrids, *Moens,* **Calisaya,** + hybrids, *Weddell,* **succirubra,** + hybrids, *Pavon,* and other species.	The dried bark, containing 5 p. c. of alkaloids.

Habitat. S. America; cultivated in Java, India, Ceylon, E. Africa, Straits Settlements; unsuccessfully in Brazil, Jamaica, Mexico, Fijis, etc.

Syn. Jesuit Bark (Powder), Countess' Powder; 1. Cinch., Yellow Cinchona, Calisaya Bark, Yellow Peruvian Bark, Cinchona Flava, Cinchonæ Flavæ Cortex;

Fr. Quinquina (Calisaya) jaune; Ger. China Regia, Kalisayarinde, Königschina. 2. Cinch. Rub., Red Peruvian Bark, Red Bark, Saint Ann's Bark; Br. Cinchonæ Rubræ Cortex; Fr. Quinquina rouge; Ger. Cortex Chinæ, Chinarinde, Rothe Chinarinde.

Cin-cho'na, better *Chinchona*, after Countess Ana de Osorio, wife of fourth Count of Chinchon, Spanish Viceroy of Peru (Chinchon, a town in Spain, near Madrid). She was cured of tertian fever by this bark, 1638, through the recommendation of a Jesuit, brought it to Europe, 1640, extolled its virtues, and thus published the hitherto Jesuit secret.

Ledg-er-i-a'na. L. Ledgerian, of or belonging to Ledger—*i. e.*, after C. Ledger, who obtained the seed, 1865, from the Caupolican province, Bolivia.

Cal-i-sa'ya. Name given the bark by Spaniards and Indians.

Suc-ci-ru'bra. L. *succus*, juice, + *ruber*, red—*i. e.*, sap first colorless, then white, and red on exposure.

Quina (Gheena), Peruv. Indian name for bark; *quina-quina*—medicinal bark; this name they apply also to other barks, and from it comes Fr. Quinquina rouge; Ger. China, very similar to Sp. *cascarilla*, dim. of *cascara*.

PLANTS.—Evergreen trees, 6–24 M. (20–80°) high, .1–.6 M. (4–24') thick; leaves opposite, entire, caducous, bright green, shining, glabrous above, paler, pubescent beneath (best scrobiculate, except *C. succirubra*), lamina 7.5–20 Cm. (3–8') long, 2.5–7.5 Cm. (1–3') broad, ovate, midrib prominent often purplish, petiole pubescent, reddish; flowers tubular, pinkish, fragrant, 15 Mm. ($\frac{3}{5}$') long, 5-divided; fruit dehiscent capsule, 12–18 Mm. ($\frac{1}{2}$–$\frac{3}{4}$') long, ovate, smooth, 2-celled, seeds winged, numerous. BARK (*C. Ledgeriana*, + *C. Calisaya*), in quills, .3–1 M. (1–3°) long, 1–5 Cm. ($\frac{2}{5}$–2') broad, curved pieces and broken fragments of variable size, 3–7 Mm. ($\frac{1}{8}$–$\frac{1}{4}$') thick, gray, rarely brownish-gray, numerous intersecting transverse and longitudinal fissures with nearly vertical sides, usually patches of foliaceous lichens with small brownish-black apothecia; cinnamon-brown when outer bark absent; inner surface cinnamon-brown, finely striate; fracture short and granular (outer), finely splintery (inner); bast-fibres mostly singly, few in 2's–3's; medullary rays narrow, laticiferous ducts visible only in young (inferior) bark; distinguished (mature bark, 6–9 years old) by profuse reticulations of fine intersecting fissures with vertical sides and absence of strong ridges, "chicken-leg appearance"—not in young bark, which often is rich in alkaloids; demand increasing owing to richness in quinine —75 p. c. of total alkaloids; (*C. succirubra*), in quills, curved pieces and broken fragments of variable size, 2–7 Mm. ($\frac{1}{12}$–$\frac{1}{4}$') thick, gray, brownish-gray, reddish-brown, rough from corky protuberances, occasionally transverse fissures, rarely numerous or much intersected, but with sloping sides, occasional patches of foliaceous lichens; inner surface reddish, orange-brown, distinctly striate; fracture short and granular (outer), shortly and rather coarsely splintery (inner); distinguished (mature bark, 6–9 years old) by strong longitudinal ridges and fissures rarely intersecting, bast-fibres mostly in 2's–5's, often more, a row of laticiferous ducts in outer bark; odor faintly aromatic; taste very bitter, astringent. POWDER, reddish-brown, light brown; microscopically—bast-fibres fusiform, yellowish, lignified, few starch grains, .003–.015 Mm. ($\frac{1}{8325}$–$\frac{1}{1650}$') broad, many sphenoidal micro-crystals of calcium oxalate. *Test:* 1. Heat 1 Gm. in dry test-tube—tarry distillate purplish, granular (*C. Ledgeriana*, + *C. Calisaya*, or bright red (*C. succirubra*); demand decreasing owing to weakness in quinine —20–40 p. c., in spite of high yield of cinchonidine, along with some cinchonine and quinidine. *Solvents:* alcohol (75 p. c.); acidified water. Dose, gr. 15–60 (1–4 Gm.).

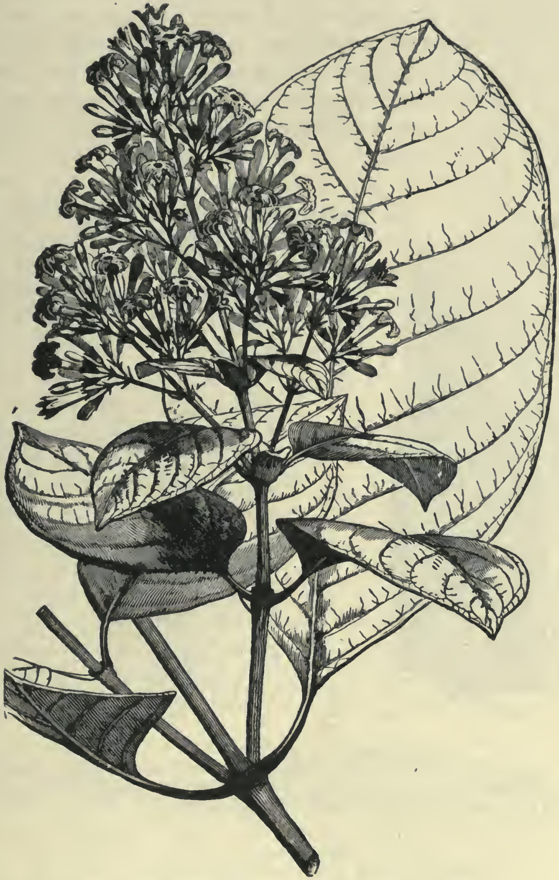


Fig. 377.—*Cinchona succirubra.*

Adulterations.—Inferior grades through ignorance, substituting one variety for another intentionally, Maracaibo for the yellow; barks treated with ammonia gas (thereby producing cinchona-red) for red bark; powder with residual inferior barks.

Commercial.—Plants natively hug mountain sides; in S. America from 10° north latitude to 20° south latitude, on the eastern slopes of central Andes chain (Bolivia to Peru, Ecuador) and western Cordilleras chain, thence to the highlands of Colombia, Venezuela, Caracas, and

Caribbean Sea. Of the 36 species recognized, the 3 official with their hybrids are considered the richest alkaloid producers, that upon which value depends. Formerly the slight variation in color of the bark and specific district sufficed to impress trade importance, but this now turns solely upon assay, making the following classification largely of historic interest: 1, *Yellow* (*C. Ledgeriana, C. Calisaya*); 2, *Red* (*C. succirubra*); 3, *Pale* (*Crown, Loxa—C. officinalis*, var. (*a*) *Condamin'ea*, (*b*) *Bonplan'da*, (*c*) *cris'pa;* 4, *Gray* (*C. nit'ida, C. micrantha, C. peruviana*); 5, *Colombian* (*C. pitayensis, C. lancifo'lia, C. cordifolia*). The best species flourish where mean annual temperature is 13° C. (55° F.) and rainy season continues 9 months, rainfall being heavy at night with intermingled fog and sunshine during the day—the other 3 months (Jan., Feb., March) having nights frequently below freezing and days 24° C. (75° F.) with dense fogs; inferior species thrive where moisture is less uniform and average temperature 20° C. (68° F.). Valleys, owing to all locations having to be well-drained, are not so desirable as forest slopes, where trees grow singly or few together at an elevation of 1500–2400 M. (5000–8000°); *C. barbacœn'cis*—most worthless species, so low as 100 M. (330°), while *C. succirubra* is valuable at 700 M. (2300°), and others do well at 3500 M. (11500°). Their area is limited to within 11 degrees north and south of Loja (Loxa), outside of which barks are almost worthless, the most southern being

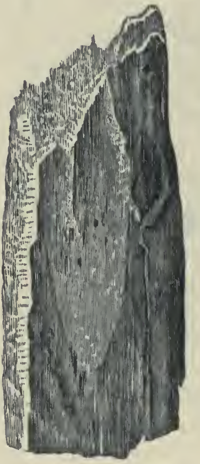


FIG. 378. — Calisaya bark, showing digital furrow and short fibrous fracture.

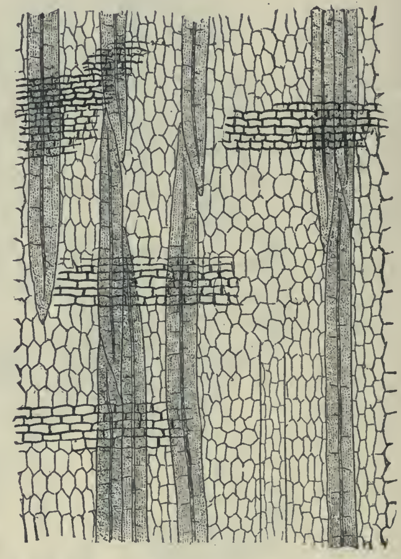


FIG. 379.—Calisaya bark: radial longitudinal section through liber, showing cinchona bast-fibres, bast parenchyma, and medullary rays, magnified 60 diam.

C. austra'lis, the most northern *C. tucujen'sis* and *C. cordifolia*. The alkaloids reside largely in the cork and bast-layer of old bark, while that of young bark contains absolutely none; the root-bark of all species is the richest, that of the branches the poorest.

Cultivation.—Cinchona trees, growing natively in mountain forests along with bamboos, begonias, coca, fuchsias, orchids, palms, tree ferns, etc., mostly unprotected and without owners, became, as a rule, common property and a prey to mercenary parties having little regard for future production; with increasing demand and decreasing supply it was only a question of time when the destruction would be complete, a condition that naturally aroused the concern of medical and other scientific men. Although the natives guarded jealously their indigenous inheritance, early endeavoring to prevent its transplanting through foreign visitation and interests, yet it was surmised correctly that the plant would flourish anywhere under approximate climatic conditions. La Condamine first attempted the experiment with failure in 1737; Dr. Weddell sent seeds to France, 1846–1847, that yielded only ornamental plants, while Hasskarl and Junghuhn (Dutch) were the first, 1853, to obtain practical results from plants they collected and sent to Batavia. Then followed Markham (English), 1859, Ledger, Spruce, Cross, and others, who in various visits to S. America procured seeds, cuttings and scions which were distributed to India, Ceylon, Java, where now three-fourths of the world's bark is grown by cultivation. In fact the native product is so deficient in alkaloids (2–4 p. c.) that it constitutes only about 5 p. c. (1 p. c. from wild, 4 p. c. from cultivated) of the sum-total annually used, and as all demand is for cultivated tree-bark, its commerce has been revolutionized in quantity, quality,

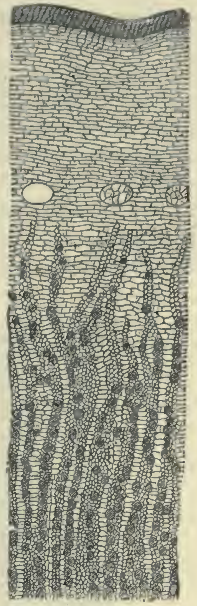


FIG. 380.—*Cinchona succirubra:* transverse section of bark, magnified 30 diam.

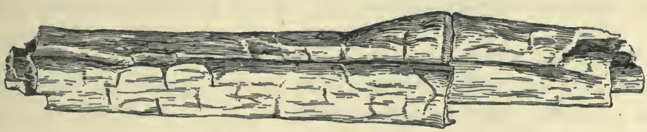


FIG. 381.—*Cinchona Calisaya* (young): natural size.

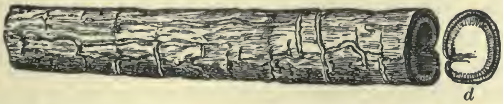


FIG. 382.—*Cinchona succirubra:* natural quill; *d*, transverse section.

and price. The genus, Cinchona, hybridizes well, so that species and varieties have been formed yielding 5, 10, 15 p. c. of total alkaloids (red—5–8–11 p. c.), and those yielding only 3–4 p. c. are in S. India and Java, uprooted by whole plantations and replaced by supposed richer hybrids. Propagation by cuttings is slow, so seeds are planted in nurseries, scions grafted and transplanted into orchards, which are cared for like cultivated fruit trees. *C. Calisaya*, and *C. Ledgeriana* (by some considered only a variety of the former) are the species, owing to their richness in quinine, mostly cultivated, the latter largely predominating, while *C. succirubra* has almost been abandoned. Most of the cultivated bark is grown in Java, considerable in India; formerly a great deal was produced in Ceylon, but a disease fatal to the trees and the substitution of tea-planting have almost eliminated that supply; Bolivia and the Straits Settlements furnish some. When trees about 15 years old the bark becomes more or less worthless, consequently they are cut down and replaced. The mountains best adapted for this cultivation are Neilgherry, Himalaya, and Blue.

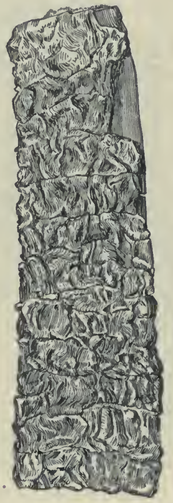


FIG. 383.—*Mossed C. officinalis* (Nat.).

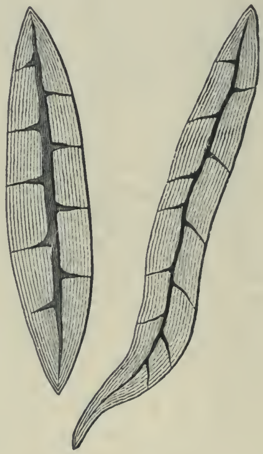


FIG. 384.—Cinchona bast-fibres.

Collection. 1. *Wild S. American Bark.*—Formerly this was collected by gangs of *cascarilleros,* managed for companies by majordomos; each gang left the seacoast in dry weather on donkeys, for the distant mountains, being away several months, and upon arriving in the cinchona districts, encamped near a stream, planted corn and beans, built huts, and depended upon game for meat. Having with a mallet loosened, then removed the lower trunk-bark, the tree was felled and stripped entirely of bark, which was carried to the huts and, in the sun or under shelter, allowed to dry in quills or pieces pressed flat by rocks, and when dried, the best was put in canvas bundles (150 pounds; 70

Kg.) and the return trip begun. At the coast ports these bundles were sewed up in fresh hides, forming, when dry, tight seroons, which were shipped as such, or in bales or boxes, from Guayaquil, Payta, Lima, Carthagena, Santa Marta, Buenos Ayres, etc. Bolivia is the only local country in which the trees are cultivated.

2. *Cultivated India Bark.*—This is cared for and collected in several ways: 1, *Uprooting,* which consists in pulling up and barking the whole tree and replanting the ground—the bark of each tree-part being marketed separately; 2, *Coppicing,* mostly practised, and consists in felling the trees, allowing shoots to spring from the stumps, and collecting the bark as soon as "ripe," when plants 6–9 years old and trunks 15–20 Cm. (6–8′) thick—as such furnishing when in quills, "Druggists' bark," or when broken up and compressed to save transportation charges, "Manufacturers' bark," being purchased upon assay-unit, each unit corresponding to 1 p. c. of quinine in a pound (.5 Kg.); 3, *Shaving,* which consists of shaving off with drawing-knives the outer bark of plants 3–5 years old, leaving intact the liber, upon which another growth of richer bark soon forms; 4, *Mossing,* which consists of taking off yearly alternating strips of bark and covering the decorticated portion with moss, grass, straw, hay, rags, paper, etc., thereby giving an annual yield of rich bark (*mossed, renewed*) during the tree's entire life. Bark thus covered is stronger in alkaloids, as it prevents the sun converting the alkaloids into coloring matter, especially on the side exposed to direct rays (most quinine and quinidine in bark from trees grown in mid-woods (shade), most cinchonidine and cinchonine from trees exposed to sun). The last two methods not only furnish richest bark, but also replace it rapidly, at the same time they are attended with the drawback of exposing new-forming bark-cells to the attack of stage-beetles, ants, etc. The average annual exportation of cinchona bark is about as follows: Java 14,726,000 pounds (6,693,190 Kg.); India 1,020,000 pounds (63,640 Kg.); Ceylon 407,000 pounds (185,000 Kg.); S. America 775,000 pounds (352,273 Kg.); Africa 178,872 pounds (81,305 Kg.). Most of the cultivated bark is in quills, whereas most of the wild-grown was in large pieces (*tabla*), thereby rendering examination easy.

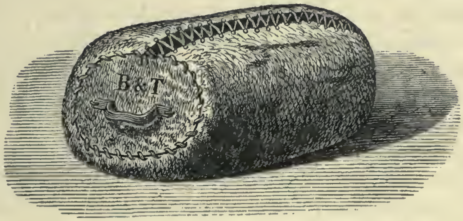


Fig. 385.—Cinchona seroon.

Constituents.—From 21–32 natural alkaloids: Quinine, Quinidine, Cinchonine, Cinchonidine, Quinamine, Chinoidine, (Conquinamine, Cupreine, Homoquinine, Hydroquinine, Paytine, Concusconine, etc.); 8 artificial alkaloids: Quinicine, Cinchonicine, Quinamicine, Apoquinamine, etc., Quinic acid, Quinovic acid, Cincho-tannic acid, Quinovin, Cinchona-red, volatile oil, resin, starch, gum, sugar, wax, calcium oxalate, ash 1–3 p. c.

The first 4 alkaloids are the most important, and can be obtained by mixing a concentrated infusion of cinchona with milk of lime, whereby this latter combines with the acids and coloring matter, thus liberating the alkaloids; now strain, and exhaust the residue with boiling alcohol (benzin, kerosene), acidify with sulphuric acid, treat with animal charcoal, filter, and while hot neutralize with sodium hydroxide V. S., when quinine sulphate crystallizes out; to the mother-liquor add large excess of ammonia water, which precipitates cinchonine and cinchonidine, while quinidine remains in solution; dissolve the precipitate in boiling alcohol, and upon cooling cinchonine separates; by evaporating the two remaining solutions we get on the one hand cinchonidine, and on the other quinidine. The respective salts may be prepared by dissolving the several alkaloids in water, adding sufficient of the desired acid for neutralization, allowing to crystallize.

Quinina, Quinine, $C_{20}H_{24}N_2O_2 + 3H_2O$, *official.*—(Syn., Quin., Chininum; Fr. Quinine; Ger. Chinin.) This alkaloid, obtained from the bark of various cinchona species, may be prepared by precipitating a solution of quinine sulphate in acidified water with an alkali, thereby yielding the anhydrous, white, curdy, amorphous alkaloid, which by being kept under water changes to the crystalline form. It is a white, micro-crystalline powder, odorless, bitter taste, developing rather slowly, but intense and persistent, efflorescent, soluble in water (1560), boiling water (800), alcohol (.8), chloroform (1.1), ether (1.9), ammonia water (1890); alcoholic solution (1 in 10) lævorotatory, alkaline; solution in sulphuric acid—vivid blue fluorescence. *Tests:* 1. Aqueous solution (1 in 100) 1 Ml. (Cc.) + diluted sulphuric acid to dissolve, + ammonia water 1 Ml. (Cc.), + 2–3 drops of bromine T. S.—emerald-green color (thalleioquin). 2. Dry to constant weight—loses 15 p. c.; incinerate 1 Gm.—ash .1 p. c. *Impurities:* Morphine, ammonium salts, organic substances. Should be kept dark, in well-closed containers. Dose, gr. 1–20 (.06–1.3 Gm.).

Quininæ Bisulphas, Quinine Bisulphate, $C_{20}H_{24}N_2O_2.H_2SO_4 + 7H_2O$, *official.*—(Syn., Quin. Bisulph., Quininæ Sulphas Acidus; Fr. Sulfate acide (Bisulfate) de Quinine (neutre); Ger. Chininum bisulfuricum, Saures Chininsulfat.) This acid sulphate is obtained by dissolving neutral quinine sulphate (100) in warm distilled water (500) + diluted sulphuric acid (115), setting aside to crystallize. It is in colorless, transparent, whitish, orthorhombic crystals or small needles, odorless, very bitter taste, efflorescent, yellow on exposure to light, soluble in water (9), boiling water (.7), alcohol (23), hot alcohol (.7), glycerin (15), chloroform (625), ether (2500). *Tests:* 1. Aqueous solution (1 in 100) 1 Ml. (Cc.) + ammonia water 1 Ml. (Cc.), + 1–2 drops of bromine T. S.—emerald-green color (thalleioquin). 2. Aqueous solution with barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. 3. Dry to constant weight—loses 25 p. c.; incinerate 2 Gm.—ash .05 p. c. *Impurities:* Morphine, organic substances. Should be kept dark, in well-closed containers. Dose, gr. 1–20 (.06–1.3 Gm.).

Quininæ Hydrobromidum, Quinine Hydrobromide, $C_{20}H_{24}N_2O_2.HBr. + H_2O$, *official.*—(Syn., Quin. Hydrobr., Quinine Bromide, Quininæ Hydrobromas; Fr. Bromhydrate de Quinine (basique); Ger. Chininhydrobromat, Bromwasserstoffsaures Chinin.) Obtained by dissolving quinine (alkaloid) in warm diluted hydrobromic acid, neutralizing, crystallizing; may also be made by double decomposition between quinine sulphate and barium bromide, in hot water. It is in white, light, silky needles, odorless, very bitter taste, efflorescent, soluble in water (40), hot water (3.2), alcohol (.9), glycerin (7), chloroform (.6), ether (23); saturated aqueous solution neutral, slightly alkaline; with diluted sulphuric acid—vivid blue fluorescence. *Tests:* 1. Aqueous solution (1 in 100) 1 Ml. (Cc.), + 1–2 drops of bromine T. S., + ammonia water 1 Ml. (Cc.)—emerald-green color (thalleioquin). 2. Saturated aqueous solution with sodium hydroxide T. S. —white precipitate; supersaturate filtrate with acetic acid, add chloroform + little chlorine water, shake—chloroform reddish-brown color; dried to constant weight—loses 5 p. c.; incinerate 2 Gm.—ash .05 p. c. *Impurities:* Barium, morphine, sulphate, organic substances. Should be kept dark, in well-closed containers. Dose, gr. 1–20 (.06–1.3 Gm.).

Quininæ Hydrochloridum, Quinine Hydrochloride, $C_{20}H_{24}N_2O_2.HCl + 2H_2O$, *official.*—(Syn., Quin. Hydrochl., Quinine Chloride, Quininæ Hydrochloras, Muriate of Quinine; Fr. Chlorhydrate de Quinine (basique); Ger. Chininum hydrochloricum, Chininhydrochlorid, Salzsaures Chinin.) Obtained by dissolving quinine in warm diluted hydrochloric acid until solution neutral, crystallizing; or by double decomposition of quinine sulphate and barium chloride, in hot water. It is in white, silky, glistening needles, odorless, very bitter taste, efflorescent, soluble in water (18), hot water (.5), alcohol (.8), glycerin (7), chloroform (.7), ether (340); aqueous solution (1 in 20) neutral, slightly alkaline, non-fluorescent, except when highly diluted or diluted sulphuric acid added. *Tests:* 1. Aqueous solution (1 in 100) 1 Ml. (Cc.) + 1–2 drops of bromine T. S., + ammonia water 1 Ml. (Cc.)—emerald-green color (thalleioquin). 2. Aqueous solution (1 in 20) with silver nitrate T. S.—white precipitate, insoluble in nitric acid; dried to constant weight—loses 10 p. c.; incinerate 2 Gm.—ash .05 p. c. *Impurities:* Barium, morphine, sulphate, organic substances. Should be kept dark, in well-closed containers. Dose, gr. 1–20 (.06–1.3 Gm.).

Quininæ Dihydrochloridum, Quinine Dihydrochloride, $C_{20}H_{24}N_2O_2.2HCl$, *official.*—(Syn., Quin. Dihydrochl., Quinine Bimuriate; Br. Quininæ Hydrochloridum Acidum, Acid Quinine Hydrochloride; Fr. Chlorhydrate acide de Quinine; Ger. Chininum dihydrochloricum, Chinindihydrochlorid.) Obtained by dissolving quinine hydrochloride (10) in distilled water (20), adding 25 p. c. hydrochloric acid (3.7), crystallizing; may also be made by double decomposition between quinine bisulphate and barium chloride. It is a white powder, odorless, very bitter taste, soluble in water (.6), alcohol (12), slightly in chloroform, very slightly in ether; aqueous solution (1 in 20) strongly acid. *Tests:* 1. Aqueous solution (1 in 20) with silver nitrate T. S.—white precipitate, insoluble in nitric acid. 2. Aqueous solution (1 in 100) 1 Ml. (Cc.), + 1–2 drops of bromine water T. S., + excess of ammonia water —emerald-green color (thalleioquin); incinerate 2 Gm.—ash .05 p. c. *Impurities:* Barium, sulphate, readily carbonizable substances. Should be kept dark, in well-closed containers. Owing to great solubility very valuable hypodermically—whooping-cough of children, etc. Dose, gr. 1–20 (.06–1.3 Gm.); child, gr. 1–5 (.06–.3 Gm.), 25 p. c. solution.

Quininæ Salicylas, Quinine Salicylate, $C_{20}H_{24}N_2O_2.HC_7H_5O_3 + H_2O$, *official.*—(Syn., Quin. Salicyl.; Fr. Salicylate de Quinine (basique); Chininsalicylat, Salicylsaures Chinin.) Obtained by dissolving quinine sulphate (10) in boiling water (75), adding sodium salicylate (3.89) dissolved in water (30), washing precipitate; or neutralize alcoholic solution of quinine with salicylic acid, concentrate, crystallize; or double decompose solution of quinine hydrochloride with sodium salicylate. It is in colorless, odorless needles, bitter taste, permanent, turning pinkish on keeping, soluble in alcohol (14), glycerin (13), chloroform (25), ether (160), slightly in water; aqueous solution (1 in 20) alkaline. *Tests:* 1. Aqueous solution 10 Ml. (Cc.), + 1–2 drops of bromine T. S., + excess of ammonia water—emerald-green color (thalleioquin). 2. Aqueous solution (1 in 20) with 1 drop of ferric chloride T. S.—violet color; dried to constant weight—loses 5 p. c.; incinerate 2 Gm.—ash .05 p. c. *Impurities:* Chloride, sulphate. Should be kept dark, in well-closed containers. Dose, gr. 1–20 (.06–1.3 Gm.).

Quininæ Sulphas, Quinine Sulphate, $(C_{20}H_{24}N_2O_2)_2.H_2SO_4 + 7H_2O$, *official.*—(Syn., Quin. Sulph., Quininæ Sulphas, Sulfas Quinicus; Fr. Sulfate de Quinine (basique); Ger. Chininum sulfuricum, Chininsulfat, Schwefelsaures Chinin.) Obtained by exhausting powdered bark with acidified water (HCl, H_2SO_4), precipitating with an alkali; or by mixing powdered bark with milk of lime, dissolving out alkaloids with petroleum oil, treating with diluted sulphuric acid, neutralizing with sodium carbonate, crystallizing. It is in white, silky, light, flexible, glistening crystals, making a very light, easily compressible mass, or hard, prismatic, monoclinic needles, odorless, persistent, very bitter taste, efflorescent (rapidly), becoming lustreless, brownish on exposure, soluble in water (725), hot water (47), alcohol (107), hot alcohol (12), glycerin (30), slightly in chloroform, ether, freely in a mixture of chloroform (7) and dehydrated alcohol (4); saturated aqueous solution neutral, slightly alkaline; with diluted sulphuric acid—vivid blue fluorescence. *Tests:* 1. Aqueous solution (1 in 1000) 10 Ml. (Cc.), + 1–2 drops of bromine T. S., + excess of ammonia water—emerald-green color (thalleioquin). 2. Aqueous solution with barium chloride T. S.—white precipitate, insoluble in hydrochloric acid; dried to constant weight—loses 16.2 p. c.; incinerate 2 Gm.—ash .05 p. c. *Impurities:* Cinchona alkaloids, ammonium sulphate, inorganic salts, morphine, organic substances. Should be kept dark, in well-closed containers. Dose, gr. 1–20–40 (.06–1.3–2.6 Gm.).

Most of the world's supply of quinine is produced by 20 factories: France—5, America—4, England—3, Germany—2, Italy—2, Bengal, Holland, Java, Madras Presidency, each—1; the average annual Asiatic output is about: Madras—15.711 pounds (7.141 Kg.), Bengal—11.297 pounds (5.135 Kg.), Java—43.750 pounds (19.886 Kg.).

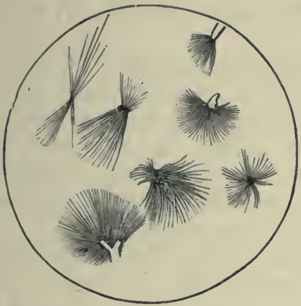


Fig. 386.—Quinine sulphate: microscopic crystals.

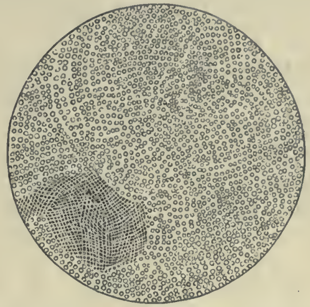


Fig. 387.—Quinine sulphate with KSCy: microscopic granules.

Quininæ Tannas, Quinine Tannate, $C_{20}H_{24}N_2O_2.3C_{14}H_{10}O_9 + 8H_2O$, *official.*—(Syn., Quin. Tann., Tasteless (Neutral) Quinine; Fr. Tannate de Quinine; Ger. Chininum tannicum, Chinintannat, Gerbsaures Chinin.) Obtained by dissolving quinine sulphate (9) in water (225), + 16 p. c. sulphuric acid (10), adding to filtrate tannic acid (21) + sodium bicarbonate (3.5) dissolved in water (250), washing precipitate, drying, pulverizing. It is a pale yellow, yellowish-white, amorphous powder, odorless, tasteless, slightly bitter, astringent taste, slightly soluble in water, chloroform, ether, somewhat more so in alcohol;

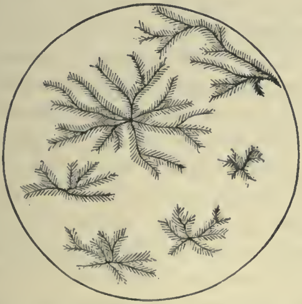


Fig. 388.—Quinidine sulphate with KSCy: microscopic crystals.

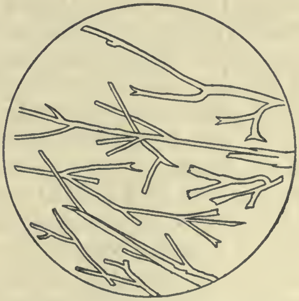


Fig. 389.—Cinchonine sulphate with KSCy: microscopic crystals.

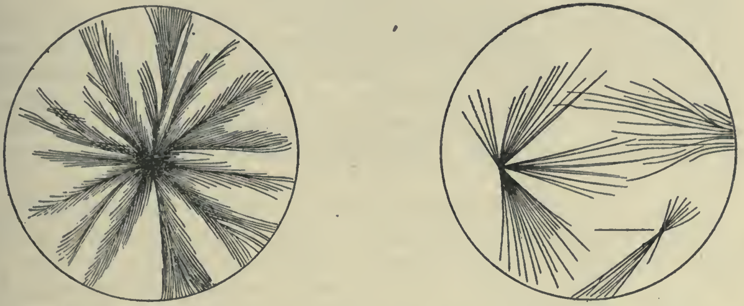
melts to purplish, viscous mass; contains 30–35 p. c. of anhydrous quinine, composition being somewhat varying. *Tests:* 1. Aqueous or alcoholic solution with ferric chloride T. S.—blue-black color. 2. Dry to constant weight—loses 10 p. c.; incinerate .5 Gm.—ash .3 p. c. *Impurities:* Uncombined quinine, chloride, sulphate. Should be kept dark, in well-closed containers. Dose, gr. 1–10 (.06–.6 Gm.); excellent for children in diarrhœa, whooping-cough, but too insoluble as an antiperiodic—in syrup, mucilage, chocolate (quinine chocolates); troches 1 gr., +.

Quininæ et Ureæ Hydrochloridum, Quinine and Urea Hydrochloride, $C_{20}H_{24}N_2O_2.HCl.CO(NH_2)_2.HCl + 5H_2O$., *official.*—(Syn., Quin. et Urea. Hydrochl., Quinine and Urea Chloride, Carbamidated Quinine Dihydrochloride; Fr. Chlorhydrate de Quinine et de Urée; Ger. Chinin-Harnstoff Hydrochlorid, Chininum bimuriaticum carbamidatum.) Obtained by dissolving quinine hydrochloride (400) in diluted hydrochloric acid (800), mixing solution with urea, $CO(NH_2)_2$, (58), warming until dissolved, filtering through glass wool, crystallizing, washing crystals, drying. It is in colorless, translucent prisms, white, granular powder, odorless, very bitter taste, permanent, soluble in water (.9), alcohol (2.4); aqueous solution (1 in 20) strongly acid; contains 58 p. c. of anhydrous quinine. *Tests:* 1. To a cold solution of 1 Gm. in 2 Ml. (Cc.) of distilled water add 2 Ml. (Cc.) of nitric acid, cool to 0° C. (32° F.)—leaflets of urea nitrate on standing; after draining dissolve in little distilled water, + few drops of mercuric nitrate T. S. + sodium hydroxide T. S.—white precipitate. 2. Aqueous solution with silver nitrate T. S.—white precipitate, insoluble in nitric acid; incinerate 2 Gm.—ash .05 p. c. *Impurities:* Ammonium compounds, readily carbonizable matter. Should be kept dark, in well-closed containers. Dose, gr. 1–20 (.06–1.3 Gm.); chiefly hypodermically, one dose daily, in 50 p. c. solution.

Quinidina, Quinidine, $C_{20}H_{24}N_2O_2$.—This is fluorescent, isomeric with quinine; with chlorine or bromine water + ammonia water—emerald-green color or precipitate; precipitated from the other alkaloids by potassium iodide, but not by alkaline oxalates in neutral solution; forms numerous salts, sulphate, bisulphate, hydriodide, etc. Dose, gr. 1–30 (.06–2 Gm.).

Cinchonina, Cinchonine, $C_{19}H_{22}N_2O$.—It is in white lustrous prisms or needles, odorless, at first nearly tasteless, becoming bitter, soluble in alcohol (116), water (3760), chloroform (163), ether (526), no residue, precipitated from acid solution by ammonia water by which it is dissolved sparingly, but soluble in 300 parts of ether (dif. from quinine, quinidine, cinchonidine). Dose, gr. 1–30 (.06–2 Gm.).

Cinchoninæ Sulphas, Cinchonine Sulphate, $(C_{19}H_{22}N_2O)_2.H_2SO_4 + 2H_2O$, *official.*—(Syn., Cinchonin. Sulph., Cinchoniæ Sulphas; Fr. Sulfate de Cinchonine; Ger. Cinchoninum sulfuricum, Cinchoninsulfat, Schwefelsaures Cinchonin.) It is in white, lustrous prismatic crystals, permanent, odorless, very bitter taste, soluble in water (60), hot water (33), alcohol (12.5), warm alcohol (7), chloroform (47), ether (3230); saturated aqueous solution neutral, slightly alkaline, dextrorotatory. *Tests:* 1. Aqueous solution (1 in 100) + barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. 2. Dry to constant weight—loses 5 p. c.; incinerate 1 Gm.—ash .1 p. c.; solution in diluted sulphuric acid (1 in 1000)—slight blue fluorescence. *Impurities:* Quinine or cinchonidine sulphate, readily carbonizable, organic substances. Should be kept dark, in well-closed containers. Dose, gr. 1–30 (.06–2 Gm.).



Figs. 390, 391.—Cinchonidine sulphate with KSCy: microscopic crystals.

Cinchonidina, Cinchonidine, $C_{19}H_{22}N_2O$.—This is non-fluorescent, isomeric with cinchonine; with chlorine or bromine water + ammonia water—white color or precipitate; soluble in alcohol (20), ether (188), water (1,600), precipitated from its associated alkaloids by sodium tartrate. Dose, gr. 1–30 (.06–2 Gm.).

Cinchonidinæ Sulphas, Cinchonidine Sulphate, $(C_{19}H_{22}N_2O)_2.H_2SO_4 + 3H_2O$, *official.*—(Syn., Cinchonid. Sulph.; Fr. Sulfate de Cinchonidine (basique); Ger. Cinchonidinum sulfuricum, Cinchonidinsulfat.) It is in white, glistening, silky needles, prisms, permanent, odorless, very bitter taste, soluble in water (65), hot water (22), alcohol (90), warm alcohol (41), chloroform (620), nearly insoluble in ether; saturated aqueous solution neutral, faintly alkaline, lævorotatory; when anhydrous melts at 200° C. (392° F.) with partial decomposition. *Tests:* 1. Aqueous solution + barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. 2. Aqueous solution (1 in 80) + ammonia water—white precipitate (cinchonidine), slightly soluble in ammonia water, but when fresh soluble in ether (5), afterward separating in crystals. 3. Dry to constant weight—loses 12 p. c.; incinerate 1 Gm.—ash .1 p. c.; solution in diluted sulphuric acid (1 in 1000)—faint blue fluorescence. *Impurities:* Cinchonine or quinidine sulphate, readily carbonizable substances. Should be kept dark, in well-closed containers. Dose, gr. 1–30 (.06–2 Gm.).

Quinami(n)a, Quinamine, $C_{19}H_{24}N_2O_2$.—In long white prisms, non-fluorescent, nearly tasteless, acid solution very bitter, soluble in ether, hot alcohol.

Chinoidinum, Chinoidine, Quinoidine; official 1880–1890.—A blackish amorphous alkaloid, resulting from evaporation of mother-liquor of the preceding alkaloids, and precipitating with sodium hydroxide—purify by dissolving in dilute hydrochloric acid, precipitating by ammonia, washing, drying; it is one-half the strength of quinine. Dose, gr. 2–30 (.13–2 Gm.).

Quinic Acid (Kinic, Chinic or Cinchonic), $C_7H_{12}O_6$.—5–9 p. c.

Quinovic Acid (Kinovic), $C_{32}H_{48}O_6$.—Tasteless shining crystals.

Cincho tannic Acid (Quino-tannic), $C_{14}H_{16}O_9$.—3–4 p. c.

The alkaloids are combined with one or more of these acids; the first acid (quinic) with sulphuric acid and maganese dioxide yields kinone, $C_6H_4O_2$; the first and second (quinic and quinovic) produce quinates (kinates) and quinovates (kinovates), as quinate (kinate) of quinine, lime, etc.; the last (cincho-tannic) is a glucoside, being the soluble red coloring matter; when boiled with sulphuric acid gives sugar and cinchona-red.

Quinovin (Kinovin, Chinovin, Quinovic Bitter), $C_{30}H_{48}O_8$.—Bitter glucoside; to alcoholic solution add hydrochloric acid gas, get quinovic (kinovic) acid and quinovin (kinovin) sugar (mannitan).

Cinchona-red, $C_{28}H_{22}O_{14}$.—This is from cincho-tannic acid, soluble in alcohol and alkaline solutions. Red cinchona bark may contain 10 p. c.

PREPARATIONS.—I. CINCHONA (*C. Ledgeriana, C. Calisaya*, +): 1. *Fluidextractum Cinchonæ.* Fluidextract of Cinchona.—(Syn., Fldext. Cinchon., Fluid Extract of Cinchona, Fluidextract of Calisaya Bark; Br. Extractum Cinchonæ Liquidum; Fr. Extrait fluide de Quinquina jaune; Ger. Extractum Chinæ fluidum, Chinafluidextrakt, Kalisayarindenfluidextrakt.)

Manufacture: Similar to Fuidextractum Ergotæ, page 60; 1st menstruum: alcohol 80 Ml. (Cc.), glycerin 10, diluted hydrochloric acid 10; 2nd menstruum: 80 p. c. alcohol; after dissolving soft extract in the reserve, assay, and add enough 2nd menstruum for the 100 Ml. (Cc.) to contain 4–5—4.5 Gm. of alkaloids. Dose, ♏xv–60 (1–4 Ml. (Cc.)).

2. *Tinctura Cinchonæ.* Tincture of Cinchona. (Syn., Tr. Cinch., Tincture of Yellow Cinchona—Peruvian Bark, Tinctura Cinchonæ Flavæ; Fr. Teinture de Quinquina (jaune); Ger. Tinctura Chinæ, Chinatinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 101; 1st menstruum: glycerin 7.5 Ml. (Cc.), alcohol 67.5 Ml. (Cc.), water 25 Ml. (Cc.), percolate 95 Ml. (Cc.), assay, and add enough 67 p. c. alcohol for the 100 Ml. (Cc.) to contain .8–1—1 Gm. of total alkaloids. Dose, ʒj–2 (4–8 Ml. (Cc.)).

II. CINCHONA RUBRA (*C. succirubra*): 1. *Tinctura Cinchonæ Composita.* Compound Tincture of Cinchona. (Syn., Tr. Cinch. Co., Huxham's Tincture of Bark; Compound Tincture of Peruvian Bark; Fr. Teinture de Quinquina composée, Elixir fébrifuge d'Huxam; Ger. Tinctura Chinæ compositæ, Zusammengesetzte Chinatinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 101; 1st menstruum: glycerin 7.5 Ml. (Cc.), alcohol 67.5 Ml. (Cc.), water 25 Ml. (Cc.), percolate 95 Ml. (Cc.), assay, and add enough 67 p. c. alcohol for the 100 Ml. (Cc.) to contain .4–.5—.45 Gm. of total alkaloids. Dose, ʒj–2 (4–8 Ml. (Cc.)).

III. QUININA: 1. *Ferri et Quininæ Citras,* 11.5–13 p. c.

Unoff. Preps.: Elixir Cinchonæ Alkaloidorum: quinine sulphate .2, cinchonidine sulphate .1, cinchonine sulphate .1, comp. tinct. of cudbear 5, purified talc 2, aromatic elixir q. s. 100. *Compound Elixirs*—many, dose, each ʒj–3 (4–12 Ml. (Cc.)). *Extract* (75 p. c. alcohol), dose, gr. 5–15 (.3–1 Gm. *Decoction, Infusion,* each 6 p. c., + aromatic sulphuric acid 1 p. c., dose, ℥ss–2 (15–60 Ml. (Cc.)). *Fluidextract* (aqueous), red cinchona 100, hydrochloric acid 3, glycerin 12.5, water 500, + water q. s. *Oleatum Quininæ,* 25 p. c.; used externally. *Pilulæ Antiperiodicæ,* quinine sulphate 1⅖ gr. (.08 Gm.), + . *Pilulæ Antiperiodicæ sine Aloe. Pilula Quininæ Sulphates* (Br.), 82 p. c. *Syrupus Quinidinæ,* 3.3 p. c. *Tinctura Quininæ* (Br.), 2 p. c. *Tinctura Quininæ Ammoniata* (Br.), 2 p. c. *Tinctura Antiperiodica* (*Warburg's*): rhubarb 8 Gm., angelica fruit 8, inula 4, fennel 4, saffron 4, gentian 2, zedoary 2, cubeb 2, myrrh 2, camphor 2, agaric 2, pepper 35, Saigon cinnamon .75, ginger .75, quinine bisulphate 20, extract of aloes 17.5, alcohol 60 p. c. q. s. 1000, dose, ʒj–4 (4–15 Ml. (Cc.)). *Tinctura Antiperiodica sine Aloe. Vinum Quininæ,* .225 p. c., dose, ℥ss–1 (15–30 Ml. (Cc.)). *Quininæ Glycerophosphas. Q. Hypophosphis. Q. Valeras.*

PROPERTIES.—Tonic, antiperiodic, febrifuge, astringent, stomachic, antiseptic, prevents fermentation and putrefaction. The S. American Indians still consider it poisonous, and always use milder remedies for fevers, while the Ecuador cascarilleros believe their red bark is used only for dyeing. It is thought the Jesuits first discovered its medicinal properties, and not the natives, hence the name Jesuits' powder, as they sold it for its weight in silver, grain for grain. Sir Robert Talbot cured Charles II. of tertian fever with it, 1679, and then sold the secret to Louis XIV., of France, who published it in 1681. The bark is astringent, the alkaloids are not; small doses increase appetite, saliva, gastric juice, peristalsis, heart action, cerebral functions, excretion of waste products; moderate doses diminish amount of urea, uric and phosphoric acids, interfere with oxygen-carrying function of red and prevent migration of white corpuscles, lessen fever by destroying or rendering inert the infective agent causing it, and by diminishing metabolism in the tissue; large doses depress heart, produce gastric irritation, eructation, chill and fever paroxysms, headache, dizziness, perspiration; also quinine, if taken when not indicated, may produce fever, a sense of constriction about the head, ringing in the ears, vertigo, staggering, deafness, headache, delirium—*cinchonism.* Inasmuch as this will produce that which it cures, Hahnemann, it is said, was influenced by this fact, along with some others, to revive and reëstablish homeopathy as based upon *similia similibus curantur.* Quinidine and cinchonidine are similar to quinine, but cinchonidine produces less marked head symptoms. Cinchonine is the weakest alkaloid, but causes much headache and muscular weakness.

Uses.—Atonic dyspepsia, convalescence, gastric catarrh, asthma, bronchitis, amenorrhœa, enlarged spleen.

Quinine as a specific in malaria, acting as a direct poison to the *Plasmodium malariæ*, which, infesting the blood, cause the disease. In intermittents give gr. 10 (.6 Gm.) of sulphate in sweating stage, and same quantity 5 hours before the next paroxysm; in the intervals of paroxysms give arsenic. In remittents give gr. 20–30 (1.3–2 Gm.) at a dose, once or twice daily, until temperature reduced. In typhus and typhoid fevers, variola, pneumonia, pyæmia, septicæmia, neuralgia, scarlet fever, erysipelas, measles, skin affections, whooping-cough, hay fever, to stimulate uterine contraction in labor.

Cinchona bark itself it not much used now, because of its excessive bulkiness, and owing to its alkaloids presenting in such a concentrated form the medicinal properties without astringency.

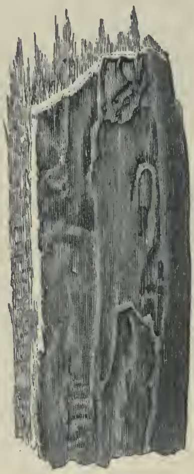


Fig. 392.—*Cinchona scrobiculata* bark.

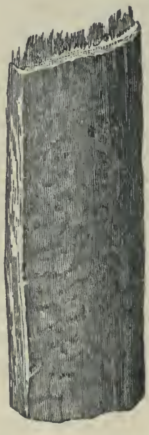


Fig. 393.—*Cinchona pubescens* bark.

Administration.—The hydrochloride, owing to its greater solubility, is the best salt of quinine for general use, the hydrobromide ranking next; the tannate and sulphate are the most insoluble and possess lower alkaloidal strength, but the latter, in spite of this, is employed mostly. The pill, capsule, or tablet disguises best the taste, but solutions are more effective, and their taste may be modified by licorice, chocolate, glycyrrhizin, yerba santa syrup or fluidextract, etc., in which condition the alkaloid should never be dissolved with acids, but simply suspended by mucilage.

Poisoning: Give potassium bromide and hydrobromic acid, and if associated with quinine will act as preventive; may need cardiac and respiratory stimulants. Morphine counteracts its cerebral action, atropine its nervous, cardiac, and antipyretic effects.

Incompatibles: Agents promoting waste: salts of mercury, copper, zinc, lead; tannin with decoction or infusion; alkalies—alkaline carbonates, alkaline earths, and iodine preparations with the alkaloidal solutions, the latter forming insoluble compounds, and all the rest precipitating them.

Synergists: Constructive agents, iron, salicylic acid, arsenic, eucalyptus, phenol, creosote.

Allied Barks:

1. *Maracaibo* or *Hard Yellow Bark* (*C. cordifo'lia*).—This constitutes nearly all of the wild-grown bark; contains 2.5 p. c. of alkaloids. 2. *Pitaya Bark* (*C. pitayen'sis*).—Smooth, with circular scars, liber reddish cinnamon-brown, splintery, powder brownish-yellow. 3. *Cusco Bark* (*C. pubes'cens*).—Pale brownish-yellow to whitish, warty periderm, liber cinnamon-color, fracture coarse-splintery; contains cuscovatine, cusconadine, cuscamine. 4. *Carthagena Bark* (*C. lancifo'lia* and *C. cordifolia*.—Like the Cusco, only liber is reddish, fracture fibrous. 5. *Lima* or *Huanuco Bark* (*C. peruvia'na, C. nit'ida, C. micran'tha*).—In quills and half-quills. 6. *Huamalies* or *Gray Bark* (*C. micran'tha, C. purpu'rea, C. glandulif'era*).—In ash-gray quills and half-quills. 7. *Jean* or *False Loxa Bark* (*C. Humboldtia'na*).—A very inferior variety.

Spurious Cinchona Barks:

1. *Cuprea* or *Copper-colored Bark* (*Remij'ia Purdiea'na, R. peduncula'ta*).—Colombia, Andes; contains alkaloids 3 p. c.—quinine 2 p. c., the rest being quinidine, cinchonine, quinovin. The quinine exists as homoquinine and cupreine, $C_{19}H_{22}N_2O_2$; this latter is red-brown with ferric chloride, and converted into quinine by methyl chloride.

2. Barks belonging to other genera as *Cascaril'la, Ladenber'gia, Nau'clea, Exostem'ma,* etc. All distinguished by *Grahe's test:* The powdered bark heated in a dry test-tube yields a tarry distillate of red color; this test applies to cuprea bark, but with these genera have no reaction. Some of these barks resemble cinchona, others do not.

Allied Plant:

1. *Mitchel'la re'pens, Partridge-berry, Squaw-vine.*—N. America. Creeping evergreen of the woods; leaves 12 Mm. ($\frac{1}{2}'$) long, ovate; flowers purplish, fruit a scarlet-red berry; contains saponin-like substance, resin, wax, gum, sugar. Tonic, astringent, diuretic; resembles chimaphila and viburnum, they all being sometimes prescribed together. Dose, ʒss–1 (2–4 Gm.).

GAMBIR. GAMBIR.

Ourouparia Gambir, *(Hunter) Baillon.* { A dried extract prepared from decoctions of the leaves and twigs.

Habitat. E. India Islands.

Syn. Pale Catechu, Catechu Pallidum, Catechu, Tarra Japonica, Gambier; Fr. Gambir cubique; Ger. Gambir Catechu, Gutta Gambir.

Ou-rou-pa'ri-a. Native name, fr. Gr. *οὐρα* tail +,—*i. e.*, the seed.

Gam'bir. Native Malayan name of the extract.

PLANT.—Strong shrubby climber, stem woody, often angular; leaves oblong-ovate, 7.5–10 Cm. (3–4′) long, petiolate, acuminate, entire, smooth; flowers small, pinkish, in clusters, calyx and corolla 5-divided, stamens 5, ovary 2-celled; fruit 2.5 Cm. (1′) long, narrow, ovoid tapering at each end, dehiscent, pericarp dry; seeds numerous, minute, pale brown, rough, tailed at each end. EXTRACT (gambir), usually in cubical or rectangular pieces 20–30 Mm. ($\frac{4}{5}$–1$\frac{1}{5}$′) broad, grayish-, reddish-brown, dull, porous, friable; internally light brown, dull earthy color; inodorous; taste bitterish, very astringent; microscopically—numerous acicular crystals, non-glandular hairs, tracheæ, few starch grains, .005–.015 Mm. ($\frac{1}{5000}$–$\frac{1}{1650}$′) broad, bacteria (?). *Tests:* 1. Macerate 1 Gm. with water (50), brownish filtrate, + dilute ferric chloride T. S.—intense green; with copper sulphate T. S.—no precipitate. *Solvents:* water dissolves 65 p. c.; alcohol 60 p. c. Dose, gr. 5–30 (.3–2 Gm.).

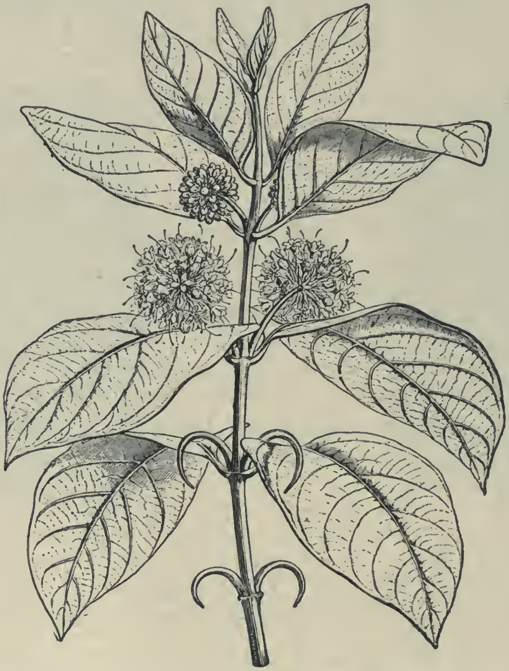


FIG. 394.—*Ourouparia Gambir:* blooming twig with the tendrils.

Commercial.—The extract is made by boiling young leafy shoots in water for 6 hours, with continued stirring and bruising, evaporating decoction to proper consistency, allowing to cool under constant and peculiar stirring; within half an hour the gambir suddenly contracts and thickens, possibly by the sudden crystallization of the catechin. It is allowed to harden in various forms, the purest in thin cakes, flakes, small cubes. Nearly all exported in wooden cases from Singapore.

Constituents.—Tannic acid 25–38 p. c., Catechin (catechuic acid) 20–29 p. c., ash 9 p. c.

Preparations.—1. *Tinctura Gambir Composita.* Compound Tincture of Gambir. (Syn., Tr. Gambir Co., Compound Tincture of Pale Catechu; Fr. Teinture de Gambir; Ger. Gambirtinktur.)

Manufacture: 5 p. c. Similar to Tinctura Aloes, page 110—using gambir 5 Gm., Saigon cinnamon 2.5 Gm.; menstruum: diluted alcohol. Dose, ʒss–2 (2–8 Ml. (Cc.)).

Unoff. Preps.: Fluidextract. Infusion. Pulvis Gambir Compositus, 40 p. c., + kino 20, krameria 20, Saigon cinnamon 10, myristica 10, dose, gr. 10–45 (.6–3 Gm.). *Tinctura Pectoralis, Bateman's Pectoral Drops*—comp. tinct. of gambir 6.4, tinct. of opium 4.2, spt. of camphor 4, oil of anise .1, caramel 1.6, dil. alc. q. s. 100. *Troches,* 1 gr. (.06 Gm.), dose, 1 occasionally.

Properties.—Similar to tannic acid, astringent, tonic. The darker colored product is most powerful, acting more energetically and harshly than kino.

Uses.—Diarrhœa, leuchorrhœa, gonorrhœa, cough, chronic sore throat, phthisis, bronchitis, hemorrhages, relaxed uvula, ulcerated nipples, chronic ulcers, relaxed oral mucous membrane and spongy gums (mouth-wash). In the arts for tanning, dyeing.

67. CAPRIFOLIACEÆ. Honeysuckle Family.

Kap-ri-fo-li-a'se-e. L. *Caprifoli-um* + aceæ—*caper,* a goat, + *folium,* leaf—*i. e.,* referring to the climbing and capering plant-habit, like a goat. Trees, shrubs, herbs. Distinguished by showy, sweet-scented flowers; leaves opposite, exstipulate; calyx 4–5-cleft, superior, persistent, tube coherent with 2–5-celled ovary; corolla 4–5-cleft, bearing as many stamens on its tube; regular or irregular; ovary 1–6-celled, inferior; filaments in pairs at each sinus; anthers 1-celled; fruit berry or drupe; temperate climates; emetic, purgative, astringent, diuretic, sudorific, acrid, poisonous.

Genus: **1. Viburnum.**

VIBURNUM PRUNIFOLIUM. VIBURNUM PRUNIFOLIUM.

Viburnum { **prunifolium,** *Linné,* / **Lentago,** *Linné.* } The dried bark, with not more than 5 p. c. of wood, foreign matter.

Habitat. United States, New York to Florida, west to Mich., Kan., Tex.; dry soil.
Syn. Viburn. Prun., Black Haw, Viburnum, Sweet Viburnum, Sheep-berry, Boots, Stag-bush, Sweet-berry, Nanny-bush (plumb); Fr. Viburnum; Ger. Viburnum.
Vi-bur'num. L. the wayfaring tree, fr. *vieo, viere,* to tie—*i. e.,* the pliability of its branches.
Pru-ni-fo'li-um. L. fr. *prunum,* a plum, + *folium,* a leaf, with a plum leaf —*i. e.,* leaves resemble those of the plum.
Len-ta'go. L. Linnean name, possibly of Spanish origin, where first found growing.

Plants.—Tall handsome shrubs, 3–6 M. (10–20°) high; leaves 2.5–5 Cm. (1–2′) long, 12–16 Mm. ($\frac{1}{2}$–$\frac{2}{3}$′) wide, opposite, smooth, shining, oval, obtuse, serrate, petioles slightly margined; flowers May, perfect, white cymes, sessile; fruit oval, black drupe (berry), sweet, edible. Bark, in irregular, transversely curved, quilled pieces, 1.5–6 Cm. ($\frac{3}{5}$–2$\frac{2}{5}$′) long, .5–1.5 Mm. ($\frac{1}{50}$–$\frac{1}{16}$′) thick, grayish-brown, or brownish-red where outer cork has scaled off, longitudinally wrinkled; inner surface reddish-brown, longitudinally striated; fracture short but uneven, showing in young or medium thick bark a dark brown cork, brownish-red outer cortex, and whitish inner cortex having numerous yellowish groups of sclerenchymatous tissues; odor slight; taste distinctly bitter, somewhat astringent. Powder, dark brown; microscopically—numerous stone cells, few bast-fibres, rosette aggregates of calcium oxalate, occasionally in crystal fibres. *Solvents:* hot water; diluted alcohol. Dose, ʒss–2 (2–8 Gm.).

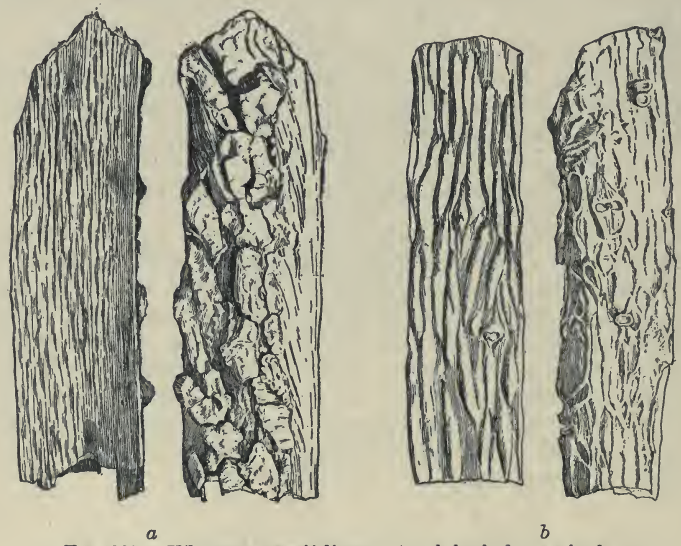


Fig. 395.—*Viburnum prunifolium; a*, trunk bark, *b*, root bark.

Constituents.—Viburnin, Valeric acid, resin (brown, bitter) 2.5 p. c., tannin, sugar, oxalates, citrates, malates, ash 8–9 p. c.—earthy carbonates and phosphates (calcium, magnesium, potassium).

Preparations.—1. *Extractum Viburni Prunifolii.* Extract of Viburnum Prunifolium. (Syn., Ext. Viburn. Prun., Powdered Extract of Viburnum Prunifolium, Extract of Black Haw Bark; Fr. Extrait de Viburn(e)-um; Ger. Viburnumextrakt.)

Manufacture: Macerate, percolate 100 Gm. with diluted alcohol until exhausted, reclaim alcohol, evaporate residue in a dish at 70° C. (158° F.) to soft extract, thoroughly incorporate magnesium oxide .5 Gm., spread on glass plates, expose to current of warm air until dry, pulverize, add enough dried starch for extract to weigh 20 Gm., mix thoroughly, pass through fine sieve; 1 Gm. represents 5 Gm. of the drug. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. 3–10 (.2–.6 Gm.).

2. *Fluidextractum Viburni Prunifolii.* Fluidextract of Viburnum Prunifolium. (Syn., Fldext. Viburn. Prun., Fluid Extract of Viburnum Prunifolium, Fluidextract of Black Haw (Bark); Fr. Extrait fluide de Viburn(e)-um; Ger. Viburnumfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: 67 p. c. alcohol. Dose, ʒss–2 (2–8 Ml. (Cc.)).

Unoff. Preps.: Decoction, 5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)). *Elixir,* 12.5 p. c. (fldext.), + comp. tinct. of cardamom 7.5, aromatic elixir q. s. 100. *Infusion,* 5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)).

Properties.—Diuretic, tonic, antispasmodic, nervine, astringent.

Uses.—In threatened abortion, nervous diseases of pregnancy, dysmenorrhœa, after-pains, ovarian irritation, menorrhagia, asthma, hysteria.

Allied Plants:

1. *Viburnum Op'ulus; Cramp Bark, High Cranberry.*—The dried bark (of the stem), official 1890–1910; United States, low grounds, north and west. Handsome perennial shrub, 1.3–3.5 M. (4–12°) high; stem smooth, branched; leaves 3-lobed, dentate; flowers cymes, large, greenish-white; fruit 12 Mm. (½′) long, ovoid, red (substitute for cranberries). Bark, nearly flat strips, 20–30 Cm. (8–12′) long, 12–18 Mm. (½–¾′) broad, .5–2 Mm. ($\frac{1}{50}$–$\frac{1}{12}$′) thick, grayish, with brown lenticels, wrinkled; inner surface light brown, striate, fracture uneven fibrous; odor slight; taste astringent, bitter; solvents: hot water, alcohol (67 p. c.); contains viburnin, valeric acid, resin, tannin, salts, ash 8–9 p. c. Diuretic, tonic, antispasmodic, nervine, astringent—much weaker than *V. prunifolium;* nervous conditions of pregnancy, abortion preventive, dysmenorrhœa, menorrhagia, ovarian irritation, asthma, hysteria. Dose, ʒss–2 (2–8 Gm.; elixir comp., 7.5 p. c. (fldext.), + fldext. of trillium 15, fldext. of aletris 7.5, comp. elixir of taraxacum q. s. 100; tincture comp., 3.5 p. c., + dioscorea 3.5, scutellaria 1, clove 5, Saigon cinnamon 6.5, glycerin 7.5, alcohol (75 p. c.) q. s. 100, dose, ʒj–2 (4–8 Ml. (Cc.)); substitute for Hayden's Viburnum Compound; fluidextract (67 p. c. alcohol), ʒss–2 (2–8 Ml. (Cc.)); decoction, infusion, each 5 p. c., ℥j–2 (30–60 Ml. (Cc.)). *V. obova'tum, Small Viburnum, Black Haw,* S. United States; shrub 2.4 M. (8°) high, fruit black, leaves broadly obovate, leathery, bitter; also used as antiperiodic.

2. *Trios'teum perfolia'tum, Fever Root, Fever-wort, Horse-gentian.*—The root (rhizome), official 1820–1880; United States. Perennial herb 1–1.3 M. (3–4°) high, hirsute; leaves pubescent beneath, 15 Cm. (6′) long; flowers purplish, fruit dry yellow drupe, 12 Mm. (½′) long. Root 15–20 Cm. (6–8′) long, 15 Mm. (⅗′) thick, knotty, brownish-yellow, bitter, nauseous; contains bitter principle, starch. Used as cathartic, emetic, diuretic, substitute for ipecac; in decoction, extract,

infusion. Popular with Indians for fevers, amenorrhœa. Dose, gr. 15–30 (1–2 Gm.).

3. *Sambu'cus canaden'sis, Sambucus, Elder.*—The flowers, official 1820–1900; N. America (damp places). Semi-shrubby perennial, slightly woody, 1.5–3 M. (5–10°) high; stem branching, covered with rough, pitted-gray bark, central pith large, branches smooth; fruit, ovoid drupe, 6 Mm. ($\frac{1}{4}$′) long, red then purplish-black. Flowers, corymbose cymes, cream-white, when dry pale brownish-yellow; odor peculiar; taste aromatic, bitter; become worm-eaten unless a preservative (sodium chloride) is added; contain volatile oil .3–.5 p. c., resin, fat, wax, mucilage, tannin. Stimulant, carminative, diaphoretic, sudorific, diuretic, alterative, flavoring; used mostly externally in fomentation, poultice, and ointment; rheumatism, erysipelas, abscesses, etc.; the water for cooling application to the eyes. Dose, ʒss–1 (2–4 Gm.). *S. ni'gra.*—Europe; tree, 4.5–6 M. (15–20°) high, 10–15 Cm. (4–6′) thick, compound cymes smaller than the preceding. *S. Eb'ulus, Dwarf Elder.* All parts with strong, disagreeable odor, bitterish, acrid taste, the 4-seeded fruit, resembling elderberries; laxative; *S. maderen'sis,* Madeira; less aromatic than *S. nigra.*

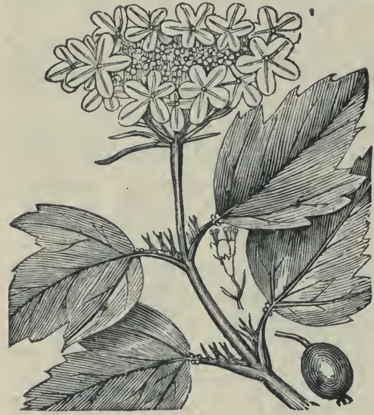


FIG. 396.—*Viburnum Opulus.*

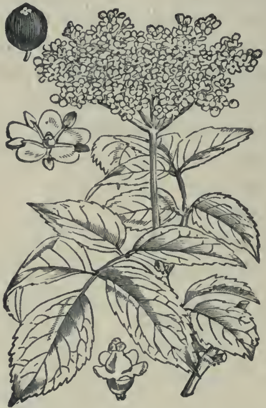


FIG. 397.—*Sambucus canadensis.*

68. VALERIANACEÆ. Valerian Family.

Va-le-ri-a-na'se-e. L. *Valerian-a* + aceæ, fr. *Valerianus* or *Valerius,* who first used it in medicine—*valere,* to be strong, healthful—*i. e.,* its odor and medicinal virtues. Herbs. Distinguished by possessing a strong-scented volatile oil; leaves opposite, exstipulate; calyx superior, tube adnate to ovary; corolla mostly 5-lobed, tubular, epigynous; stamens 1–4, inserted on corolla-tube; ovary, 1 fertile cell, 2 abortive or empty; fruit dry, often pappose; temperate climates; stimulant, antispasmodic, tonic (vol. oil).

Genus: **1. Valeriana.**

VALERIANACEÆ

VALERIANA. VALERIAN.

Valeriana officinalis, *Linné.* } The dried rhizome and roots.

Habitat. Europe, N. Asia, in moist as well as dry localities, banks of streams; naturalized in New England and New York; cultivated.

Syn. Valer., Wild, Great Wild, English, German, Common, Cat's, Vermont or American-English Valerian, Setwall, Vandal Root, All Heal, Radix Valerianæ Minoris; Br. Valerianæ Rhizoma; Fr. Valériane officinale, Racine de Valériane; Ger. Radix Valerianæ, Baldrian, (Wilde) Baldrianwurzel.

Va-le-ri-a'na. L. see etymology, page 578, of Valerianaceæ.
Of-fi-ci-na'lis. L. see etymology of (*Asagræa*) *officinalis,* page 102.

Plant.—Large perennial herb; stem .6–1.3 M. (2–4°) high, branched at top, cylindrical, hollow, fluted and channeled, often hairy; leaves imparipinnate with long clasping petioles; leaflets 4–10 pairs, 2.5–6.5 Cm. (1–2$\frac{1}{2}$′) long, lanceolate, dentate; flowers small, white or rose color, agreeably odorous, terminal corymbs, corolla 5-lobed, stamens 3, sessile; fruit, capsule, 4 Mm. ($\frac{1}{6}$′) long, plano-convex, compressed, 4-ribbed, pale brown, 1-seeded, oblong-ovate. Rhizome, upright, 2–4 Cm. ($\frac{4}{5}$–1$\frac{3}{5}$′) long, 1–2 Cm. $\frac{2}{5}$–$\frac{4}{5}$′) thick, usually cut longitudinally into 2–4 pieces, yellowish-brown, upper portion with stem-bases, frequently with a short, horizontal branch or stolon, from outer surface numerous, slender, brittle roots; fracture short, horny; internally light brown with a thick bark and narrow, central cylinder; odor pronounced, of valeric acid, stronger upon aging; taste sweetish, camphoraceous, somewhat bitter. Powder, grayish-brown; microscopically—numerous starch grains, .003–.02 Mm. ($\frac{1}{8325}$–$\frac{1}{1250}$′) broad, tracheal fragments, sclerenchymatous fibres, occasional fragments of epidermis with root hairs and fragments of cork. *Solvents:* water; alcohol. Dose, gr. 15–60 (1–4 Gm.).

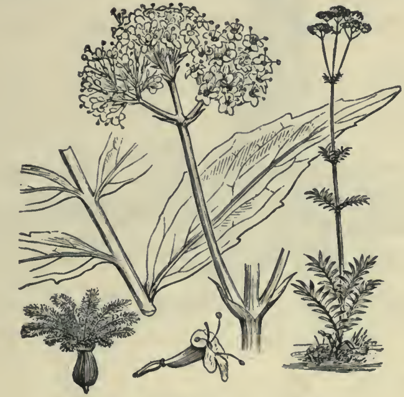


Fig. 398.—*Valeriana officinalis.*

Adulterations.—Rhizome and roots of *V. Phu, V. dioi'ca, Cynan'chum Vincetox'icum, Veratrum album, Si'um latifo'lium, Scabio'sa succi'sa,* and *S. arven'sis,* also several ranunculaceous roots.

Commercial.—Valerian flourishes equally well in damp woods, meadows, and dry places, affording a variability in characteristics that has suggested four varieties, all, however, being one and the same and yielding identical constituents; it is cultivated in England (best), Germany, Holland, United States (New Hampshire, Vermont, New York), very little of the wild grown, although stronger and smaller, being utilized. Rhizome is collected in the spring before stem begins to shoot, or preferably in autumn, when leaves decay, from dry soil plants, and at first is without specific odor; tops are cut off in the spring to prevent seeding and thereby strengthen the rhizome, which must be dug carefully, washed, dried (entire or split) in kilns, packed tightly, and kept dry to prevent deterioration.

CONSTITUENTS.—Volatile oil .5–3 p. c., Valeric acid, formic, acetic, malic acids, chatinine, tannin, resin, starch, mucilage, sugar, ash 15–20 p. c. (largely Mn.).

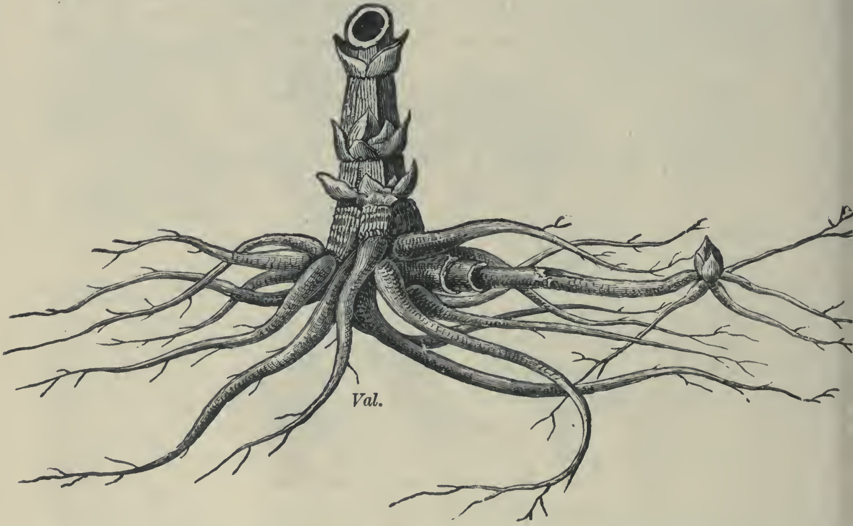


FIG. 399.—*Valeriana officinalis:* rhizome, roots, and rootlets.

Volatile Oil. (Oleum Valerianæ, official 1880–1890.)—This is obtained by distilling with water; it is a pale green liquid, pungent valerian odor, aromatic taste, sp. gr. 0.945, yellow and viscid on exposure, lævorotatory; contains: 1, a terpene—borneene, $C_{10}H_{16}$, boiling at 157° C. (315° F.); 2, an alcohol—borneol (liquid, and solid crystalline compound), $C_{10}H_{18}O$, with the liquid portion chromic acid yields camphor along with formic, acetic, and valeric acids, these latter being likewise present in old rhizomes from slow oxidation of this $C_{10}H_{18}O$; 3, an ether—borneol, or borneol oxide, $(C_{10}H_{17})_2O$, greenish syrupy oil, but colorless when rectified, along with formic, acetic, and valeric esters, which, by oxidation, form their respective acids. Recent investigators claim these components to be pinene, camphene, borneol, and the formic, acetic, and isovaleric esters of borneol. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

Valeric (Valerianic) Acid.—**Acidum Valer(ian)icum,** $C_5H_{10}O_2$, official 1870–1880. Not in fresh rhizome, but results from oxidation of the volatile oil on exposure—a change believed dependent largely upon presence of manganese; however, this is obtained mostly by oxidizing amyl alcohol with sulphuric acid and potassium dichromate. It is an oily liquid, volatile, with characteristic odor, salts sweet-tasted.

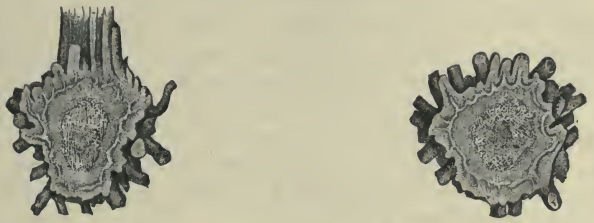


FIG. 400.—Valeriana: longitudinal and transverse sections.

PREPARATIONS.—1. *Tinctura Valerianæ.* Tincture of Valerian. (Syn., Tr. Valer.; Fr. Teinture de Valériane; Ger. Baldriantinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: 75 p. c. alcohol. Dose, ʒss–2 (2–8 Ml. (Cc.)).

2. *Tinctura Valerianæ Ammoniata.* Ammoniated Tincture of Valerian. (Syn., Tr. Valer. Ammon., Tinctura Valerianæ Composita; Fr. Teinture de Valériane ammoniacale; Ger. Ammoniakalische Baldriantinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: aromatic spirit of ammonia. Dose, ʒss–2 (2–8 Ml. (Cc.)).

Unoff. Preps.: Abstract, dose, gr. 5–20 (.3–1.3 Gm.). *Extract,* dose, gr. 5–10 (.3–.6 Gm.). *Fluidextract* (alcohol 80 p. c.), dose, ♏xv–60 (1–4 Ml. (Cc.)). *Infusion,* dose, ℥j–2 (30–60 Ml. (Cc.)). *Syrup. Water* (*Aqua*).

PROPERTIES.—Similar to other drugs having a volatile oil. Stimulant, anodyne, nervine, antispasmodic, vermifuge, no narcotic effect; increases heart action and temperature, causing exhilaration, stimulates circulation, secretion, and peristalsis of the stomach and intestines; it is eliminated by kidneys, bronchial and genito-urinary mucous membranes; if used continuously, may produce melancholia, hysteria. Large doses cause nausea, diarrhœa, urination, delirium, lessen motility, sensibility, and reflex excitability; the oil paralyzes the brain, spine, slows pulse, lowers blood-pressure.

USES.—Hysteria, hypochondriasis, hemicrania, nervous coughs, whooping-cough, diabetes, delirium tremens, typhoid state, dysmenorrhœa, vertigo, epilepsy, worm convulsions, flatulence, reflex neuralgia.

Allied Plants:

1. *Valeriana Phu′.*—W. Asia, S. Europe; tall perennial; rhizome (*Radix Valerianæ Majoris*) is 10–15 Cm. (4–6′) long, 12 Mm. ($\frac{1}{2}$′) thick, annulated, brown; *V. mexica′na* and *V. tolucca′na*, Mexico. All three yield valeric acid; odor and taste weaker than official.

2. *V. cel′tica* (*Nardus Spica celtica*).—Alps, and *Nardos′tachys Jataman′si, Nar′dus in′dica* (*Spica nardi*) or true spikenard, India; the former has valerian odor, the latter that of serpentaria.

69. CUCURBITACEÆ. Gourd Family.

Ku-ker-bi-ta′se-e. L. *Cucurbit-a* + aceæ, a gourd, fr. *curvitas*, crookedness—*i. e.*, referring to the fruit's shape. Herbs. Distinguished by possessing acrid, bitter, purgative properties, succulent nature, prostrate or climbing, with tendrils; leaves and stem scabrous; flowers unisexual, calyx 5-toothed, tube adnate to the ovary; corolla 5's, perigynous; stamens mostly 3, usually united; ovary 1–3-celled; inferior; fruit succulent, pulpy, edible; seeds flat, many, exalbuminous; tropics; purgative (pulp), edible, poisonous.

Genera. **1. Cucurbita. 2. Citrullus. 3. Ecballium.**

PEPO. PEPO.

Cucurbita Pepo, *Linné.* { The dried ripe seeds of cultivated varieties with not more than 5 p. c. of other substances.

Habitat. Tropical Asia, America; cultivated.

Syn. Pumpkin Seed, Pumpkin, Pompion, Cold Seeds, Semen Peponis, Semina Cucurbitæ; Fr. Semences de Potirons; Ger. Kürbissamen.

Cu-cur′bi-ta. L. see etymology, above, of Cucurbitaceæ.

Pe′po. L. fr. Gr. πέπων, pumpkin, old form, pompon, lit. cooked by the sun, ripe, mellow—*i. e.*, not eaten until ripe.

Plant.—Trailing annual; stem rough, hollow, hairy, 3–9 M. (10–30°) long, tendrils branched; leaves large, .25–.5 M. (10–20′) long, 15–30 Cm. (6–12′) wide, obtusely cordate, hispid, palmately 5-lobed, serrate, petioles 7.5–20 Cm. (3–8′) long; flowers July, large, 5–12.5 Cm. (2–5′) wide, yellow, bell-shaped, monœcious, axillary; anthers 3, syngenesious; fruit Oct., large, round, oblong, smooth, fleshy, yellow, furrowed, .25–.5 M. (10–20′) in diameter. Seeds, broadly elliptical, ovate, 15–23 Mm. ($\frac{3}{5}$–$\frac{5}{6}$′) long, 6–9 Mm. ($\frac{1}{4}$–$\frac{3}{8}$′) broad, 2–3 Mm. ($\frac{1}{12}$–$\frac{1}{8}$′) thick; yellowish-white, smooth, occasionally with thin transparent fragments of adhering pulp, shallow groove parallel to and within 1 Mm. ($\frac{1}{25}$′) of the margin; fracture short, seed-coat consisting of a white coriaceous outer layer and a membranous inner layer (sometimes dark green); embryo whitish, straight with small conical hypocotyl and 2 plano-convex cotyledons; slightly odorous when contused; taste bland, oily. Powder, yellowish-white; microscopically—epidermal cells, stone cells, parenchyma cells, endosperm cells with aleurone grains, cotyledons with cells containing fixed oil and many small aleurone grains; integuments 21 p. c., kernel 79 p. c. *Solvent:* alcohol. Dose, ℥j–2 (30–60 Gm.).

Constituents.—Fixed oil 30 p. c., proteids (myosin, vitellin), cucurbitine (?), salicylic acid, resin (yielding phytosterin, etc.) .5 p. c., sugar, ash 3–4 p. c.

Resin.—Probably the active principle, residing in the tegmen or embryo, obtained by treating the seeds, after the removal of fixed oil, with alcohol, ether, chloroform; it is soft, greenish-brown, acrid, bitter. Dose, gr. 15 (1 Gm.).

Fixed Oil.—Claimed to possess (ʒiv; 15 Ml. (Cc.)) the medicinal power of the drug, due no doubt to the presence of some resin, and is obtained by expression, or by treating seeds with benzin; consists of the glycerides of oleic, myristic, and palmitic acids. The seed-infusion saturated with sodium chloride precipitates myosin, and when CO_2 is added vitellin separates, which behaves like egg-yolk (due to its contained vitellin); the protein is possibly its emulsionizing principle.

Preparations.—(Unoff.): *Fluidextract,* dose, ℥ss–1 (15–30 Ml. (Cc.)). *Emulsion* (℥ij–4; 60–120 Gm. fresh seeds, deprived of testa, should be beaten into a paste with sugar + water or milk Oj; .5 L.), dose, ℥v (150 Ml. (Cc.)) at 2-hour intervals beginning at 10 o'clock A.M.

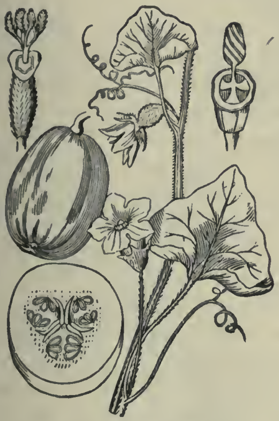


Fig. 401.—*Cucurbita Pepo.*

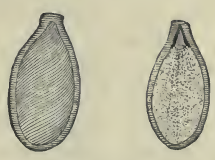


Fig. 402.—Pumpkin seed; entire and longitudinally divided, showing embryo.

Patients should remain quietly in bed all day. On the night before, and also before breakfast, give saline purgative to remove mucus, and about 3–4 hours after the pint (.5 L.) has been taken administer castor oil ℥j–2 (30–60 Ml. (Cc.)). Should fast the day previous to taking the medicine.

Properties and Uses.—Tæniafuge, vermifuge, diuretic, valuable because of its freedom from taste and harshness of action, but has the disadvantage of uncertainty. Same treatment applies to tape- and lumbricoid worms.

Allied Plant:

1. *Citrul'lus Citrullus* (*vulgaris*)—*Cucurbita* (*Cu'cumis*) *Citrullus, Watermelon Seed.*—S. Asia; cultivated. Fruit edible, very large; seed flat, ovate, 12 Mm. (½′) long, blackish, marbled, or orange-brown, ungrooved, blunt on the edge, otherwise like pumpkin seed. Kernels

contain fixed oil 7.4 p. c., petroleum benzin extract 19 p. c., proteids, sugar, resin (cucurbitol—closely related to grindelol and ipurganol); diuretic, tæniafuge, anthelmintic. Dose, ℥ij–16 (8–60 Gm.).

COLOCYNTHIS. COLOCYNTH.

Citrullus Colocynthis, *(Linné) Schrader.* { The dried pulp of fruit, with not more than 5 p. c. of seeds or 2 p. c. of epicarp.

Habitat. S. and W. Asia, N. and S. Africa, in arid places, deserts; Arabia, Syria, Egypt, Morocco, Cape of Good Hope, Greece, Spain, Japan; cultivated.

Syn. Colocyn., Colocynth Pulp, Bitter Apple, Colocynth Apple (Fruit), Cucumber, or Gourd; Br. Colocynthidis Pulpa, Colocynth Pulp, Poma Colocynthidis; Fr. Coloquinte; Ger. Fructus Colocynthidis, Koloquinthen, Coloquinthenapfel.

Ci-trul′lus. L. *citrus*, an orange, Gr. *κίτρον*, citron, Ar. origin—*i. e.*, named after color of the fruit when cut—orange-red.

Col-o-cyn′this. L. fr. Gr. *κολοκυνθίς*, the classic name of the plant.

Plant.—Perennial tendril-bearing vine; stem angular, hispid, herbaceous; leaves many-lobed, hairy, 2.5–10 Cm. (1–4′) long, subpalmately cleft on long hispid petioles; tendrils, with which it climbs, short, branching; flowers large, monœcious, both kinds similar, solitary, yellow. Fruits, before removing seeds, nearly globular, 4–7 Cm. (1$\frac{3}{5}$–3′) broad, size of a small orange, usually more or less crushed and in broken pieces, with occasional patches of nearly smooth epicarp; yellowish-white; light, spongy; separable longitudinally when entire into 3 carpels, each containing, near the outer surface, the ovoid, compressed, yellowish seeds; odor slight; taste intensely bitter. Powder, yellowish-white, buff; microscopically—fragments of parenchyma cells and tracheæ, few tissues of seed-coat with characteristic stone cells, globules of fixed oil, aleurone grains; must be made from pulp containing not more than 5 p. c. of seeds, and upon extraction with purified petroleum benzin yields not more than 2 p. c. of fixed oil. *Solvents:* alcohol; diluted alcohol; water. Dose, gr. 2–10 (.13–.6 Gm.); laxative, gr. 2–5 (.13–.3 Gm.); drastic purgative, gr. 5–10 (.3–.6 Gm.), repeated in 8–12 hours if necessary.

Commercial.—Plant resembles closely the watermelon (*C. Citrullus*—an annual with larger, smoothish leaves, and much larger sweetish fruit), and has been cultivated in English gardens since 1551. It is a very old medicine, the pulp, constituting 24.5 p. c. of the peeled fruit, being the portion that alone should be used; the separated and rejected seeds possess slight bitterness, but also a fixed oil, 12.72 p. c., that, upon removal of testa, renders the kernels (one-half oil) somewhat prized in Africa for food, bread, etc. There are two varieties: 1, *Peeled* (*Turkey*), the smaller, best, usually from the maritime plain between the mountains of Palestine and the Mediterranean; shipped chiefly from Jaffa, Trieste, that from Spain being smaller, darker, more compact, less pulp, blackish seeds; 2, *Unpeeled* (*Mogador*), the larger, inferior, covered with smooth, yellowish-brown firm rind. Fruit is gathered in autumn when turning yellow, peeled (or this, if to be done, may be deferred until after drying) and dried quickly by sun or fire; not known or used by native physicians as a cathartic, but simply as a protection against moths.

Constituents.—Pulp 24.5 p. c., Seed 75.5 p. c. Pulp contains colocynthin 2 p. c., Colocynthitin, pectin, gum (no starch), ash 15 p. c.; seeds contain alkaloid (trace), fixed oil 12.72 p. c., albuminoids 6 p. c., ash 2–4 p. c. (whole fruit 4–5 p. c.).

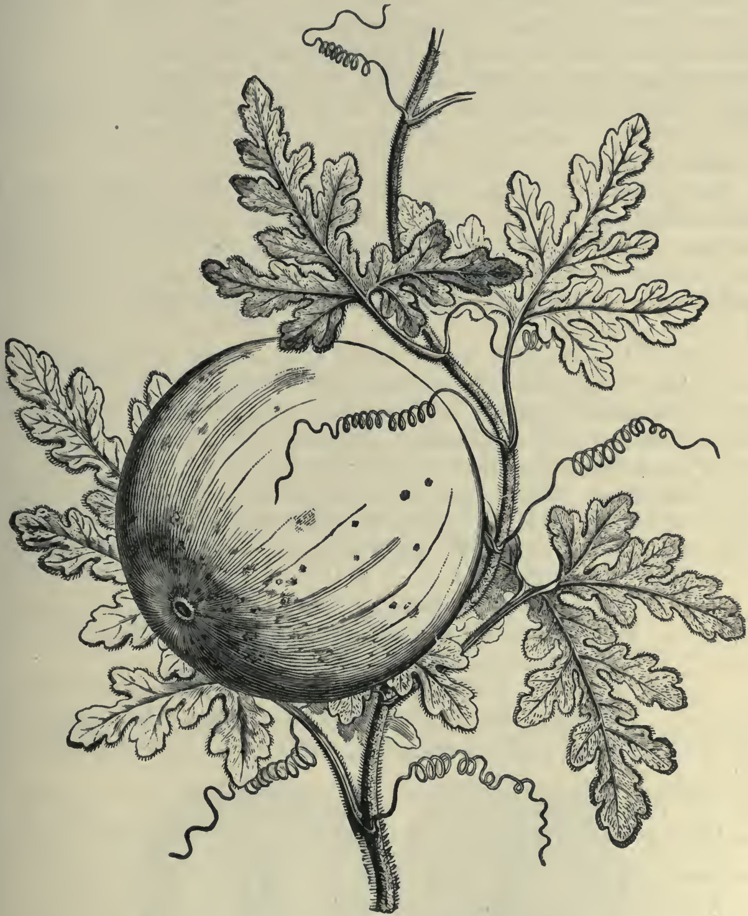


Fig. 403.—*Citrullus Colocynthis.*

Colocynthin, $C_{56}H_{84}O_{23}$.—The chief cathartic principle: an amorphous glucoside (bitter principle), obtained by exhausting with water the alcoholic extract, precipitating filtrate with lead acetate and subacetate; the yellow filtered liquid is treated with H_2S to remove lead, filtered, then precipitated with tannin. This tannate of colocynthin is dissolved in alcohol, the tannin thrown down by lead subacetate, filtered liquid digested with animal charcoal, filtered, evaporated. It is a yellow powder, soluble in water, alcohol, boiled with diluted acids splits into sugar and resinous colocynthein. Dose, gr. $\frac{1}{2}$–1 (.03–.06 Gm.)—hypodermically, gr. $\frac{1}{6}$–$\frac{1}{3}$ (.01–.02 Gm.), by which method it is painful, and should be associated with cocaine. The "Eclectic" resinoid, *colocynthin.* Dose, gr. $\frac{1}{4}$–1 (.016–.06 Gm.).

Colocynthitin (*citrullin*).—A resin left after treating alcoholic extract with cold water in preparing colocynthin; occurs in white, tasteless microscopic prisms, soluble in ether, hot alcohol.

PREPARATIONS.—1. *Extractum Colocynthidis.* Extract of Colocynth. (Syn., Ext. Colocynth., Powdered Extract of Colocynth, Extractum Colocynthidis Alcoholicum; Fr. Extrait de Coloquinte; Ger. Koloquinthenextrakt.)

Manufacture: Macerate, percolate 100 Gm. with diluted alcohol until exhausted (500 Ml. (Cc.)), reclaim alcohol, evaporate residue to dryness, pulverize, add dried starch q. s. 25 Gm.; mix thoroughly, pass through fine sieve; 1 Gm. represents 4 Gm. of the drug. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.).

Prep.: 1. *Extractum Colocynthidis Compositum.* Compound Extract of Colocynth. (Syn., Ext. Colocynth. Co., Powdered Compound Extract of Colocynth; Fr. Extrait de Coloquinte composé; Ger. Zusammengesetztes Koloquinthenextrakt.)

Manufacture: Triturate together until No. 60 powder, extract of colocynth 16 Gm., aloes 50 Gm., cardamom seed 5 Gm., resin of scammony 14 Gm., soap (dried powder) 15 Gm., pass through fine sieve. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.).

Prep.: 1. *Pilulæ Catharticæ Compositæ.* Compound Cathartic Pills. (Syn., Pil. Cathart. Co., Antibilious Pills; Fr. Pilules cathartiques composées; Ger. Abführpillen.)

Manufacture: Mix compound extract of colocynth 8 Gm., mild mercurous chloride 6 Gm., resin of jalap 2 Gm., gamboge 1.5 Gm., diluted alcohol q. s. 100 pills. Dose, 1–3 pills.

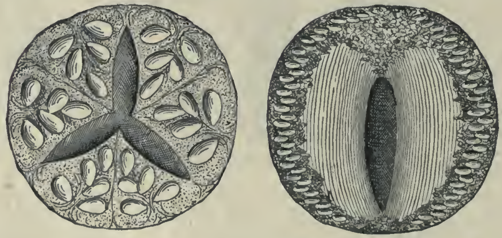


FIG. 404.—Peeled colocynth: transverse and longitudinal sections.

Unoff. Preps.: Fluidextract, dose, ♏ij–10 (.13–.6 Ml. (Cc.)). *Pilulæ Colocynthidis Compositæ*—extract of colocynth 1.1 Gm., aloes 13, resin of scammony 13, oil of clove 1.5, dil. alc. q. s. 100 pills. *Pilulæ Colocynthidis et Hyoscyami*—extract of colocynth .65 Gm., aloes, resin of scammony, extract of hyoscyamus, each 9.7, oil of clove 1, make into 100 pills. *Pilulæ Colocynthidis et Podophylli*—comp. extract of colocynth 16.2 Gm., resin of podophyllum 1.6, syrup q. s. 100 pills, dose, of each, 1–2 pills. *Tincture,* 10 p. c. (alcohol), dose, ʒss–1 (2–4 Ml. (Cc.)). *Pilulæ Laxativæ Post Partum*—comp. ext. of colocynth 11 Gm., aloes 5.5, ext. of nux vomica 2.5, resin of podophyllum .5, ipecac .5, ext. of hyoscyamus 8, dil. alc. q. s. 100 pills.

Properties.—Drastic and hydragogue cathartic, hepatic stimulant, diuretic; small doses bitter, stomachic; large doses emetic, irritant poison, causing violent griping, dangerous bowel inflammations—gr. 90 (6 Gm.) have killed.

Uses.—The Greeks and Arabians were unacquainted with its drastic effect, but prescribed it for its other properties. Now used as an evacuant, dropsy, melancholia, coma, apoplexy, paralysis, but never in pregnancy, nor where gastric or intestinal inflammation is present. It is very harsh and seldom used alone.

Poisoning: Same as for aloes, etc. Evacuate stomach, give demulcents, opium, stimulants.

Allied Plants:

1. *Luf'fa Luffa* (*ægypti'aca,*) Egypt, and *L. opercula'ta*, Brazil, *Vegetable Sponge, Wash-rag Sponge, Gourd Towel.* 2. *Cu'cumis myriocar'pus*, S. Africa. These produce analogous fruits, which have similar action to colocynth, while the derma of *Luffa* serves as sponge. 3. *Momor'dica Balsam'ina, Balsam Apple,* E. India. Climbing plant, also cultivated in gardens throughout the United States for its yellow cucumber-like fruit. This is soaked in whisky and used domestically as a vulnerary.

ECBALLIUM. SQUIRTING CUCUMBER.

Elaterinum. Elaterin, $C_{20}H_{28}O_5$, *official.*

Ecballium Elaterium, *(Linné) A. Richard.*	A principle from Elaterium, a substance deposited by the juice of the fruit.

Habitat. W. Asia, N. Africa, S. Europe—Mediterranean basin, dry waste places; cultivated.

Syn. Squirting or Wild Cucumber, Wild Balsam Apple; Fr. Concombre sauvage, Elatérine, Elatine; Ger. Eselsgurke, Springgurke, Elaterin.

Ec-bal'li-um. L. fr. Gr. ἐκ, out, + βάλλειν, to throw—*i. e.*, the fruit expelling its contents when fully ripe.

El-a-te'ri-um. L. fr. Gr. ἐλατήριον, driving out, purging—*i. e.*, its medicinal property. El-a-te-ri'num, E-lat'er-in—both simply derivative names.

Plant.—Common perennial, squash-like vine; stem trailing, tendril-bearing, succulent, bristly, .6–1.3 M. (2–4°) long; leaves cordate, 7.5–12.5 Cm. (3–5′) long, lobed, hispid, pale green; flowers monœcious, yellow; fruit 5 Cm. (2′) long, 2.5 Cm. (1′) broad, oblong, pale yellowish-green, beset with fleshy prickles, 3-celled, containing bitter, watery, mucilaginous juice in which are many light brown seeds.

Constituents.—Elaterin 44 p. c., green resin 17 p. c., starch 6 p. c.; prophetin, ecballin (elateric acid), hydroelaterin, elaterid.

Elaterinum. Elaterin.—Obtained by exhausting elaterium with hot alcohol and precipitating with water, or treating with hot chloroform and precipitating with ether, washing with ether and recrystallizing from alcohol or chloroform. It is in minute, white, hexagonal scales, prismatic crystals; odorless; slightly acrid, bitter taste, permanent, soluble in alcohol (325), boiling alcohol (100), chloroform (15.5), ether (450), benzene (310); insoluble in ether, water; alcoholic solution neutral. *Tests:* 1. Mix .01 Gm. with sulphuric acid 1 Ml. (Cc.)—only yellow color (abs. of readily carbonizable substances); + a drop of formaldehyde solution—brown. 2. Solution of .01 Gm. in 5 Ml. (Cc.) of melted phenol, + a few drops of sulphuric acid—crimson, rapidly changing to scarlet; incinerate .1 Gm.—ash nonweighable. *Impurities:* Alkaloids, readily carbonizable substances. Dose, gr. $\frac{1}{20}$–$\frac{1}{10}$ (.003–.006 Gm.).

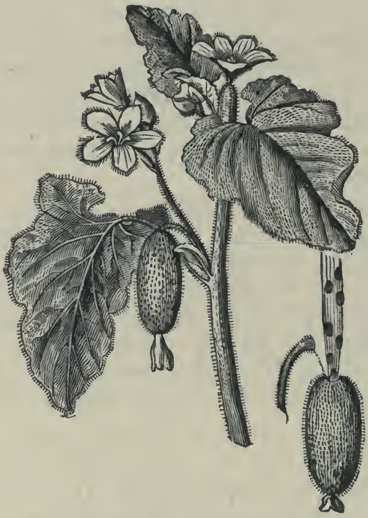


Fig. 405.—*Ecballium Elaterium.*

Adulterations.—Elaterium: Starch, calcium carbonate, various minerals colored green. Owing to this adulteration and the irregular treatment in collecting and curing, it becomes a very uncertain product, hence the official Elaterin is much to be preferred, which as a rule is pure.

Commercial.—Fruit when ripe is yellow and falls to the ground from its attachment, and at the instant of separation the entire contents are expelled violently (hence called squirting cucumber), through the socket or peduncle orifice—due to osmosis from pericarp to central pulp, causing engorgement, therefore tension and rupture at weakest point. Elaterium should be prepared from the fruit collected with the stalk, just before ripe, cutting fruit lengthwise, lightly pressing (best without pressure), straining the juice, setting aside to deposit, and putting this (sediment) on porous tiles to dry by gentle heat, avoiding exposure to the sun. Forty cucumbers without pressure yield 6 gr. (.4 Gm.), and 40 pounds (18 Kg.) yield only 240 gr. (15.5 Gm.). Elaterium occurs in grayish fragments or scales, odor tea-like, taste bitter, acrid; should not effervesce with hydrochloric acid. Dr. Clutterbuck's is considered best.

PREPARATIONS.—1. *Trituratio Elaterini.* Trituration of Elaterin. (Syn., Trit. Elaterin.; Fr. Trituration d'Elatérine; Ger. Elaterintrituration.)

Manufacture: 10 p. c. Triturate 10 Gm. with sugar of milk 90 Gm.; mix thoroughly. Dose, gr. $\frac{1}{2}$–$\frac{3}{4}$ (.03–.05 Gm.).

Unoff. Preps.: Pulvis Elaterini Compositus, 2.5 p. c., dose, gr. 1–4 (.06–.26 Gm.). *Elaterium,* dose, gr. $\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 Gm.). *Solution of Elaterium,* $\frac{1}{4}$ p. c. in alcohol + $\frac{1}{2}$ p. c. nitric acid, dose, ♏xxx (2 Ml. (Cc.)).

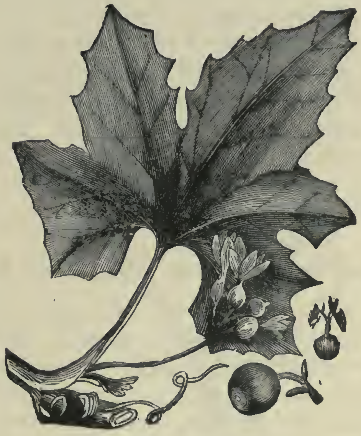


FIG. 406.—*Bryonia dioica.*

PROPERTIES.—Hydragogue cathartic (most powerful known), producing profuse watery evacuations with griping and much prostration; large doses nauseate, vomit, inflame stomach and bowels, increase flow of urine, and may kill. Does not vomit nor purge dogs, rabbits, but kills them by convulsions. Those working in it often have ulcerated fingers, eyes, etc.

USES.—The fruit was employed by the ancients, being recommended by Dioscorides in mania, melancholia. Sydenham used it in dropsy, but it fell into disfavor through its severity, until brought forward again by Dr. Ferriar. Useful in dropsy, Bright's disease with dropsy (as it is believed to eliminate more urea through the bowels than any other cathartic), brain and lung congestion, uræmia, but never in heart disease.

Poisoning: Same as for aloes, etc. Evacuate stomach, give demulcents, opium, stimulants.

Allied Plants:

1. *Bryo'nia al'ba* and *B. dioi'ca, Bryonia, Bryony.*—The dried root, collected in the spring, official 1880–1900; C. and S. Europe. Perennial climbers, the former monœcious, the latter diœcious; leaves heart-shaped, 5-lobed; flowers small, greenish-white or yellowish; fruit, berries, size of a pea, the former black, the latter red (hence names black and red bryony). Root, spindle-shaped, .3–.6 M. (1–2°) long, lactescent, fleshy, usually in transverse sections 3 Mm. ($\frac{1}{8}$') thick, 5 Cm. (2') broad, yellowish-white, cambium line brown, medullary rays broad, many wood-bundles, fracture short; inodorous, bitter; contains alkaloid (amorphous), bryonol (dihydric alcohol)—both purgative, volatile oil, resin, glucoside (inactive), enzyme, sugar, phytosterol; solvents: alcohol, hot water. Hydragogue cathartic, emmenagogue, vesicant, emetic (large doses). Used in dropsy, epilepsy, hysteria, bronchitis, whooping-cough, rheumatism, swollen glands, scabies; large doses poisonous. Dose, gr. 10–60 (.6–4 Gm.); fluidextract ♏x–60 (.6–4 Ml. (Cc.)); infusion, 5 p. c., ℥j–2 (30–60 Ml. (Cc.)); tincture, 10 p. c. (alcohol), ʒj–2 (4–8 Ml. (Cc.)); mother-tincture (homeopathic), ♏v–40 (.3–2.6 Ml. (Cc.)); bryonin, gr. $\frac{1}{6}$–$\frac{1}{3}$ (.01–.02 Gm.).

2. *Cayapo'nia america'na* (*Bryonia americana*).—W. Indies. 3. *Bryonia Kedros'tis na'na* (*africa'na*); S. Africa. Both in their respective countries are used like bryonia, especially for dropsy. 4. *B. epigœ'a;* India. Used natively as an alterative in syphilis, and as a remedy for snake-bites.

70. CAMPANULACEÆ. Bell-flower Family.

Kam-pan-u-la'se-e. L. *Campanul-a* + aceæ, dim. of *campana*, a bell—*i. e.*, from the resemblance of the corolla. Herbs, shrubs. Distinguished by alternate exstipulate leaves; acrid and usually milky juice; solitary perfect flowers, calyx 5-lobed, corolla gamopetalous, campanulate or rotate, limb 5-lobed, stamens separate or syngenesious; ovary 2–5-celled, inferior; fruit capsule or berry; temperate climates; emetic, diaphoretic, narcotic.

Genus: **1. Lobelia.**

LOBELIA. LOBELIA.

Lobelia inflata, *Linné.* { The dried leaves and flowering tops, with not more than 10 p. c. of stems, foreign matter.

Habitat. N. America (Canada, United States), in fields and open places.

Syn. Lobel., Indian Tobacco, Wild Tobacco, Green, Brown, Bladder-podded Lobelia, Emetic Herb (Weed), Asthma (Puke) Weed, Gag Root, Vomit Wort, Low Belia, Eyebright; Fr. Lobélie enflée; Ger. Herba Lobeliæ, Lobelienkraut.

Lo-be'li-a. L. after Matthias de Lobel, Flemish botanist, physician, and author of several botanical works, 1538–1616, native of Lille, became physician and botanist to James I., died in London.

In-fla'ta. L. *inflatus*, inflated, swollen—*i. e.*, seeds are borne in egg-shaped inflated pod.

CAMPANULACEÆ

PLANT.—Annual herb, .3–.6 M. (1–2°) high, erect, paniculately branched; stem cylindrical, coarsely and irregularly furrowed, yellowish green, occasionally purplish, pubescent with numerous spreading hairs; root fibrous. LEAVES, alternate, ovate, oblong, 2–9 Cm. ($\frac{4}{5}$–$3\frac{3}{5}'$) long, sessile or narrowing into a short petiole, obtusely toothed, irregularly serrate-denticulate, each tooth with a yellowish-brown, gland-like apex; pale green with scattered, bristly hairs; flowers blue, long, loose racemes with short pedicels, calyx tube ovoid with 5 subulate teeth, corolla tubular, 3–4 Mm. ($\frac{1}{8}$–$\frac{1}{6}'$) long, 5-parted, the upper 2-lobed portion cleft nearly to the base; stamens with anthers united above into a curved tube enclosing the bifid stigmas; capsules inflated, ovoid, ellipsoidal, 5–8 Mm. ($\frac{1}{5}$–$\frac{1}{3}'$) long, light brown, inferior, enclosing numerous coarsely reticulate seeds; odor slight; taste strongly acrid. POWDER, dark green, odor irritating; microscopically—fragments of seed-coat, occasionally non-glandular hairs, stem with tracheæ, leaf epidermis with elliptical stomata, pollen grains; ash 8 p. c. Loses on drying 75 p. c. *Solvents:* diluted alcohol; boiling water. Dose, expectorant, gr. 1–5 (.06–.3 Gm.); emetic, gr. 10–20 (.6–1.3 Gm.).

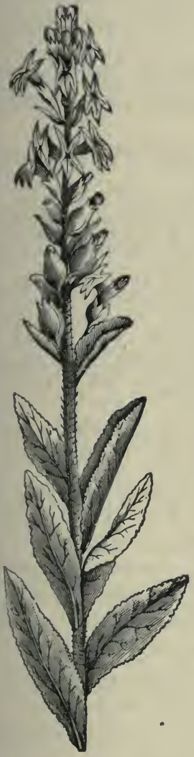


FIG. 407. — *Lobelia inflata.*

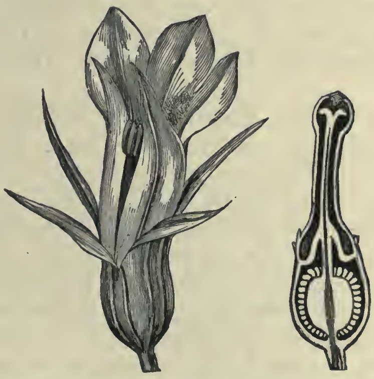


FIG. 408.—Lobelia flower and section: magnified 5 diam.

ADULTERATIONS.—Rare—except its own stems and roots.

Commercial.—Lobelia was popular with the North American Indians, but Dr. Cutler, of Massachusetts, introduced it into our medical practice. It should be collected Aug.–Sept., carefully dried, and sold loosely or in various-sized compressed packages; powder keeps well.

CONSTITUENTS.—Lobeline, Lobelacrin, Lobelic acid, Inflatin, a second alkaloid (?), resin, wax, volatile oil (lobelianin), fixed oil 30 p. c., gum, ash 8 p. c.

Lobeline.—Obtained by evaporating to syrup the acetic-alcoholic tincture (preferably of seeds), triturating this with magnesium oxide in excess, agitating filtrate with ether, evaporating, getting impure alkaloid. It is a yellow, aromatic liquid, acrid taste, convertible into amorphous powder and non-crystalline salts (hydrobromide, sulphate, etc.) soluble in water. Dose (sulphate), gr. $\frac{1}{6}$–1 (.01–.06 Gm.).

Lobelacrin.—Obtained by concentrating tincture in the presence of charcoal, washing with water, exhausting with boiling alcohol; it is the acrid principle—possibly lobelate of lobeline, brown, soluble in ether or chloroform, splitting with dilute acids or alkalies into sugar and lobelic acid.

Lobelic Acid.—Obtained by precipitating decoction of leaves with copper sulphate, and decomposing with hydrogen sulphide; it is colored olive-brown by ferric salts.

Inflatin.—Neutral principle (wax), tasteless crystals, no medicinal value.

Preparations.—1. *Fluidextractum Lobeliæ.* Fluidextract of Lobelia. (Syn., Fldext. Lobel., Fluid Extract of Lobelia; Fr. Extrait fluide de Lobélie; Ger. Lobelienkrautfluidextrakt.)

Manufacture: Similar to Fluidextractum Ergotæ, page 60; 1st menstruum: alcohol 50 Ml. (Cc.), water 45, acetic acid 5; 2nd menstruum: diluted alcohol. Dose, ♏j–5—20 (.06–.3—1.3 Ml. (Cc.)).

2. *Tinctura Lobeliæ.* Tincture of Lobelia. (Syn., Tr. Lobel.; Fr. Teinture de Lobélie; Ger. Lobelientinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: diluted alcohol. Dose, ♏v–30—60 (.3–2—4 Ml. (Cc.)).

Unoff. Preps.: Acetum, 10 p. c., dose, ♏v–60 (.3–4 Ml. (Cc.)). *Extract,* dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.). *Infusion,* dose, ℥ss–1 (15–30 Ml. (Cc.)). *Tinctura Lobeliæ Ætherea* (Br.), 20 p. c. (spirit of ether), dose, ♏v–15 (.3–1 Ml. (Cc.)). The "Eclectic" *lobelin,* made in the usual way, is an impure resinoid, dose, gr. $\frac{1}{2}$–1 (.03–.06 Gm.).

Properties.—Expectorant, emetic, nervine, purgative, narcotic, diuretic, diaphoretic; similar to ipecac, but causes more distressing nausea and intense prostration; it paralyzes the motor nerves, vasomotor centre, and peripheral vagi. Leaves chewed a short time cause giddiness, headache, tremors, nausea, vomiting; full doses give speedy and severe vomiting, general relaxation, cold skin with sweating; resembles tobacco, is dangerous, having caused many deaths.

Uses.—Spasmodic asthma, catarrh, bronchial spasms, whooping-cough, in enema for intussusception, strangulated hernia, constipation; externally for poison-ivy (oak) eczema. Should not be given as an emetic, and is too depressing for children.

Poisoning: Have burning pain in fauces, œsophagus, motor weakness, great depression, feeble pulse, low temperature, anxious, livid countenance, contracted pupils, vertigo, tremors, cold sweat, pale skin, sometimes violent purging, collapse, stupor, coma, death from respiratory failure. Place in recumbent position, empty stomach if vomiting has not been free, give tannin, cardiac and respiratory stimulants, strychnine, picrotoxin, thebaine, alcohol, digitalis, atropine or belladonna, digitalis, morphine, artificial heat, ergot, castor oil.

Incompatibles: Strychnine, picrotoxin; caustic alkalies decompose lobeline, making preparations inert.

Synergists: Emetics, motor depressants.

Allied Plants:

1. *Lobelia syphilit'ica, Great Lobelia.*—Stem .6–1 M. (2–3°) high; flowers large, 2.5 Cm. (1′) long, beautiful blue; diaphoretic. Used by the aborigines for syphilis.

2. *L. cardina'lis, Cardinal-flower.*—Stem .6–1.3 M. (2–4°) high; flowers large, showy, intense cardinal or scarlet-red. Used by Indians as anthelmintic; similar to *L. syphilitica,* but milder.

71. CICHORIACEÆ. Chicory Family.

Si-ko-ri-a'se-e. L. *Cichori-um* + aceæ, Gr. *κιχώριον, κίχορα,* fr. Egypt. *chikouryeh,* chichory, chicory, succory—*i. e.,* the original Arabic name of the characteristic plant. Herbs. Distinguished by alternate or basal leaves; milky acrid or bitter juice; flowers all alike, perfect, calyx-tube adnate to ovary, corolla gamopetalous, limb 5-toothed, anthers syngenesious; ovary 1-celled; fruit achene; universal; diuretic, tonic, aperient, deobstruent.

Genera: **1. Taraxacum. 2. Lactuca.**

TARAXACUM. TARAXACUM.

Taraxacum officinale, *Weber.* } The dried rhizome and roots.

Habitat. Europe (naturalized in N. America); grassy places, roadsides, pastures, fields.

Syn. Tarax., Dandelion, Lion's Tooth, White (Wild) Endive, Swine Snout, Cankerwort, Irish Daisy, Milk Gowan, Priest's Crown, Blow (Puff) Ball; Br. Taraxaci Radix; Fr. Pissenlit, Dent de Lion, Couronne de moine; Ger. Radix Taraxaci cum herba, Löwenzahn, Pfaffenröhrchen.

Ta-rax'a-cum. L. fr. Gr. *ταράσσω, τᾶρακτικός,* to move, disturbing—*i. e.,* its medicinal properties; name assigned the plant by medieval pharmacists.

Of-fi-ci-na'le. L. see etymology of (*Rheum*) *officinale,* page 172.

Dan'de-li'on. E. fr. L. *dens,* tooth, + *leo, leonis,* of the lion—*i. e.,* leaves shape of the lion's tooth (runcinate).

Plant.—Perennial herb, acaulescent; leaves radical, direct from root-crown, 15–22.5 Cm. (6–9′) long, 5–7.5 Cm. (2–3′) wide, toothed (runcinate), teeth bent backward, 5–6 on a side, sessile, glabrous, bright green; flowers terminal upon hollow scapes, 15–20 Cm. (6–8′) high, arising from midst of leaves, golden-yellow, 4 Cm. ($1\frac{3}{5}$′) broad, close at night; fruit achene, compressed, oblong-ovate, terminating in silky, hairy, spreading pappus, elevated on a pale greenish-white stalk, so that when mature the seed attached to this pappus is enabled to be wafted by the wind, to settle down at some distance and there propagate its kind. Rhizome, cylindrical, somewhat flattened, gradually tapering, usually in broken pieces, 6–15 Cm. ($2\frac{2}{5}$–6′) long, 5–15 Mm. ($\frac{1}{5}$–$\frac{3}{5}$′) thick, brownish, longitudinally wrinkled, numerous root- and rootlet-scars, crown simple, branched, with many leaf-bases showing annulate markings, bark 2–6 Mm. ($\frac{1}{12}$–$\frac{1}{4}'$) thick, composed of concentric layers of laticiferous vessels; odor slight, inodorous; taste bitter. Powder, light brown; microscopically—large parenchyma cells containing masses of inulin, fragments with laticiferous vessels, reticulate tracheæ, intermediate fibres non-lignified, with pores. Should be kept, after thoroughly dried, in tightly-closed containers, adding occasionally a few drops of chloroform or carbon tetrachloride to prevent insect attack. *Solvents:* diluted alcohol; boiling water. Dose, ʒss–2 (2–8 Gm.).

Adulterations.—Chiefly chicory (*Cichorium Intybus*), which closely resembles taraxacum, but is paler and has milk vessels in radiating lines.

Commercial.—Plant is universal, growing alike in dry and damp places, and was known to the Arabians as a blood-purifier. Rhizome is collected chiefly, spring, autumn, in C. Europe, and loses upon drying 75–85 p. c.; it is sweet after cold weather (early spring), owing to uncrystallizable sugar, 17 p. c., and levulin, 18.7 p. c., but these by autumn go into or are replaced by inulin, in consequence of which the milk-juice becomes thicker and more bitter, causing some to believe it then most efficient; that collected in June, July, August may be valuable but is unreliable from lack of uniformity. Extract made from early spring collection is reliable, clear from presence of so little inulin (1.74 p. c.), and often preferred, while that from October collection is equally reliable, but opaque from excessive amount of inulin (24 p. c.),

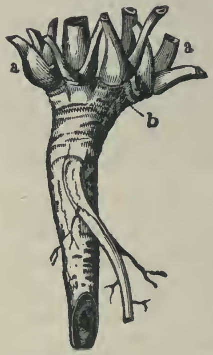


Fig. 410. — *Taraxacum officinale:* rhizome revealing at head the remnants of flower stalks and leaf stalks.

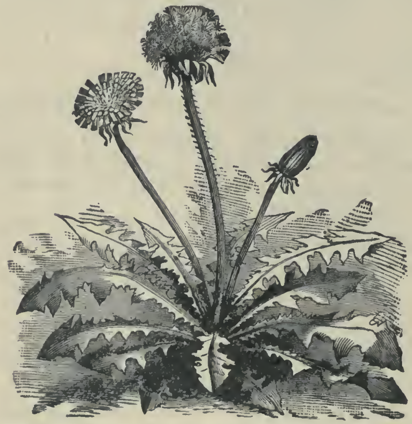


Fig. 409.—*Taraxacum officinale.*

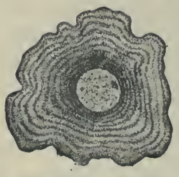


Fig. 411.—Taraxacum: transverse section of root.

and by many considered best. Dried root often is attacked by maggots, and hence should not be kept beyond a year.

CONSTITUENTS.—Milk-juice (containing taraxacin, taraxacerin, 2 resins, and glutinous body), reducing sugars, levulin, inulin (yellow with iodine) 24 p. c., pectin, ash 5–10 p. c.

Taraxacin.—Obtained by treating milk-juice with boiling water, evaporating; it is a crystalline bitter principle, non-volatile, acrid, soluble in hot water, alcohol, and ether.

Taraxacerin, $C_8H_{16}O$.—Obtained by treating milk-juice with hot alcohol; it is crystallizable, insoluble in water, soluble in alcohol. Old extracts may contain calcium lactate crystals, the lactic acid being produced from inosite, which is present in the leaves and stalks, but not believed to be in the root.

PREPARATIONS.—1. *Extractum Taraxaci.* Extract of Taraxacum. (Syn., Ext. Tarax., Extract of Dandelion; Fr. Extrait de Pissenlit; Ger. Löwenzahnextrakt.)

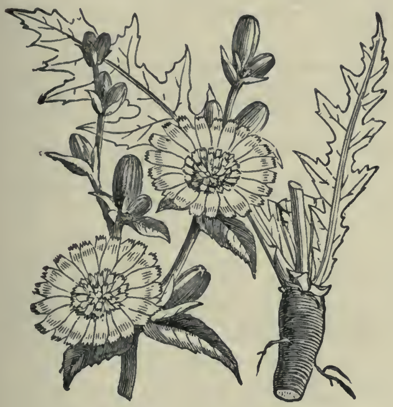


FIG. 412.—*Cichorium Intybus.*

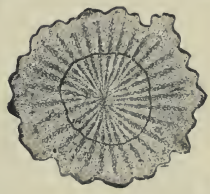


FIG. 413.—Cichorium: transverse section.

Manufacture: Macerate, percolate 100 Gm. with 12.5 p. c. alcohol until exhausted, reclaim alcohol, evaporate residue on water-bath, frequently stirring, to pilular consistence. Dose, gr. 5–30 (.3–2 Gm.).

2. *Fluidextractum Taraxaci.* Fluidextract of Taraxacum. (Syn., Fldext. Tarax., Fluid Extract of Taraxacum, Fluidextract of Dandelion, Extractum Taraxaci Liquidum; Fr. Extrait fluide de Pissenlit; Ger. Löwenzahnfluidextrakt.)

Manufacture: Similar to Fluidextractum Ergotæ, page 60; 1st menstruum: alcohol 50 Ml. (Cc.), water 40, glycerin 10; 2nd menstruum: diluted alcohol. Dose, ʒss–2 (2–8 Ml. (Cc.)).

Unoff. Preps.: Decoction, 5 p. c., dose, ℥j–2 (30–60 Ml. (Cc.)). *Elixir Taraxaci Compositum,* 3.5 p. c. (fldext.), + fldext. of wild cherry 2, fldext. of glycyrrhiza 6, +. *Succus Taraxaci* (Br.), expressed juice (3) and alcohol (1), dose, ʒj–2 (4–8 Ml. (Cc.)).

PROPERTIES.—Diuretic, tonic, stomachic, aperient, deobstruent.

USES.—Congestion and inflammation of liver and spleen, dyspepsia, constipation, consumption, skin affections, dropsies, substitute for coffee. Fresh leaves sometimes used as salad.

Allied Plants:

1. *Cicho'rium In'tybus, Chicory.*—Europe, naturalized in United States. Root with laticiferous vessels radiate, also is whiter, more woody, and has thinner bark than taraxacum. July collection contains 36 p. c. of inulin, bitter principle, etc., and has properties similar to taraxacum root, with which it often is mixed as an adulterant. Roasted root is used frequently to adulterate coffee. *C. Endiv'ia, Endive;* Levant; cultivated for its bitter leaves.

LACTUCARIUM. LACTUCARIUM.

Lactuca virosa, *Linné.* } The dried milk-juice.

Habitat. C. and S. Europe, W. Siberia, naturalized in New England; cultivated.

Syn. Lactucar., Acrid Lettuce, Wild Lettuce, German Lactucarium, Strong-scented Lettuce, Prickly Lettuce, Green Endive; Fr. Laitue vireuse, Lactucarium; Ger. Giftlattichsaft.

Lac-tu'ca L. *lac, lactis,* milk—*i. e.,* from the milky juice which exudes when plant is punctured or broken.

Vi-ro'sa. L. *virosus,* poisoning—*i. e.,* its medicinal properties or odor opium-like.

Lac-tu-ca'ri-um. L. *lactuca,* lettuce, of or belonging to lettuce.

PLANT.—Biennial herb with brown tap-root; stem .6–2 M. (2–6°) high, erect, glabrous, prickly, pale glaucous-green, often purple-spotted; leaves runcinate—radical .4–.5 M. (16–18′) long, obovate, entire—cauline smaller, few, sessile, spinose apex and margin; base auriculate, pale glaucous-green, midrib spiny beneath; flowers Aug., pale yellow, 12–25 Mm. (½–1′) broad, panicles. MILK-JUICE (lactucarium), usually in quarter sections of hemispherical masses, or irregular, angular pieces, dull reddish-brown, grayish-brown; fracture tough, waxy; internally light brown, yellowish, somewhat porous; odor distinctive, opium-like; taste bitter. POWDER, brownish; microscopically — irregular fragments without cellular structure, which, mounted in hydrated chloral T. S., become clear, showing granular fragments, and from this deposit numerous rod-shaped crystals, broad monoclinic prisms, and aggregates of these, all polarizing light. *Tests:* 1. Triturate with water — turbid mixture; with boiling water — filtrate clear while hot, turbid on cooling, but clears with ammonia water or alcohol; with iodine T. S.—not colored blue (abs. of starch). 2. Alcoholic solution + a drop of ferric chloride T. S.—only a faint green color (abs. of tannin). Pulverizes more readily after drying at 70° C. (158° F.); contains moisture 15 p. c.; juice loses in drying 75 p. c.

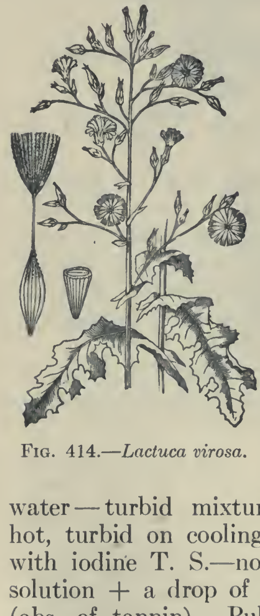


FIG. 414.—*Lactuca virosa.*

Solvents: water dissolves 51 p. c., diluted alcohol 36–44 p. c., spirit of chloroform 55–60 p. c., being mostly lactucerin. Dose, gr. 1–8–15 (.06–.5–1 Gm.).

Commercial.—Plant, cultivated chiefly in Germany, France, Great Britain, Austria, has a disagreeable, narcotic odor, a bitter saline taste, and all parts abound in a white, milky juice that instantly exudes upon being wounded, becoming when dried official lactucarium. There are three varieties: 1, *English,* collected in England, Scotland when stalks become thick and succulent, and flower buds appear, Aug.–Sept., by collectors passing up the rows, cutting off the heads of each stalk, and scraping the exuding juice into small tin vessels—two scrapers following one cutter—a process repeated 6–7 times daily for several weeks, each cut being made a little lower down the stalk. By night the juice has thickened into a viscid mass when it is turned out of the vessels, divided into suitable size pieces, and dried by gentle heat for about 5 days, losing 75 p. c. in weight—the yield per plant being ʒiij–4 (12–15 Gm.), of dried product 40–50 grains (2.6–3.3 Gm.); it is difficult to powder and emulsifies only with acacia; 2, *German,* prepared chiefly near Zell, small town on the Moselle, by cutting the stems off, just before flowering, a foot (.3 M.) below the apex, and thereafter removing daily, May–Sept., a thin transverse slice, when the white exuding juice, soon turning brown, is scraped from the scarified top with the finger and put into earthen pots where it quickly hardens; it then is turned out on frames to dry in the air, and enters market in angular lumps; 3, *French* (*Aubergier's*), originally cultivated and used by Aubergier, being the milky juice of *L. sagitta'ta* (*altis'sima*) collected in glass vessels from transverse incisions made daily in the stem from above downward; upon coagulation it is shaped into circular cakes, 4 Cm. (1⅗′) thick, and dried on sieves; seldom reaches our market. *Thridace* is the juice of *L. sativa* obtained like lactucarium, or expressed from the stalks, clarified by coagulation, expressed and inspissated—*Lactucarium Gallicum.* Some countries prefer the dried expressed juice, or extract of fresh stalks with 65 p. c. of alcohol, or alcoholic extract of fresh juice.

Constituents.—Lactucerin (lactucon) 50–60 p. c., Lactucin, Lactucic acid, Lactucopicrin, (caoutchouc, resin, sugar, oxalic, citric, and malic acids, gum, wax, asparagin, volatile oil, ash 10 p. c.).

Lactucerin, $C_{28}H_{44}O_2$.—Obtained from lactucarium with boiling alcohol and recrystallization; forms thin, colorless, tasteless, odorless needles, and is claimed to be the acetate of alpha- and beta-lactucerol, soluble in hot alcohol, chloroform, ether, benzin, oils.

Lactucin, $C_{11}H_{12}O_3H_2O$.—This gives most of the bitter taste; occurs in odorless, white pearly scales or rhombic plates, soluble in hot water, alcohol, cold water (60), insoluble in ether, turns red and then brown by alkalies, losing its bitterness, and by oxidation produces lactucopicrin. Dose, gr. 1–4 (.06–.26 Gm.).

Lactucic Acid and **Lactucopicrin,** $C_{44}H_{32}O_{21}$.—These are in the mother-liquor of lactucin, the former being crystalline, bitter, red with alkalies; the latter amorphous, bitter, both soluble in water, alcohol.

Preparations.—1. *Tinctura Lactucarii.* Tincture of Lactucarium. (Syn., Tr. Lactucar.; Fr. Teinture de Lactucarium; Ger. Lactucariumtinktur.)

Manufacture: 50 p. c. Beat lactucarium 50 Gm. to a coarse powder with clean sand, to this in a bottle add purified petroleum benzin 200 Ml. (Cc.) (to remove inert resinous lactucerin, caoutchouc, etc.), cork tightly, set aside 48 hours, frequently agitating, pour mixture on double filter, drain, wash residue gradually with purified petroleum benzin 150 Ml. (Cc.); when lactucarium dry and free from benzin odor from exposure, pulverize, using more sand, if necessary, pack, macerate, and percolate with glycerin 25 Ml. (Cc.), alcohol 50 Ml. (Cc.), water 25 Ml. (Cc.), continuing with diluted alcohol until exhausted, reserving the first 75 Ml. (Cc.) of percolate; evaporate remainder to 25 Ml. (Cc.) and mix it with the reserve, filter, wash filter with diluted alcohol q. s. 100 Ml. (Cc.). Dose, ʒss–1 (2–4 Ml. (Cc.)).

> Prep.: 1. *Syrupus Lactucarii.* Syrup of Lactucarium. (Syn., Syr. Lactucar.; Fr. Sirop de Lactucarium; Ger. Lactucariumsirup.)
>
> *Manufacture:* 5 p. c. Mix tincture of lactucarium 10 Ml. (Cc.) with glycerin 20 Ml. (Cc.), add orange flower water 5 Ml. (Cc.) in which has previously been dissolved citric acid .1 Gm., filter, add syrup q. s. 100 Ml. (Cc.). Dose, ʒj–4 (4–15 Ml. (Cc.)).

Unoff. Preps.: Fluidextract, dose, ♏j–30 (.06–2 Ml. (Cc.)). *Lozenges.*

Properties.—Anodyne, sedative, hypnotic, diuretic, expectorant, very unreliable, milder than opium, and, unlike it, does not derange the digestive organs.

Uses.—Where opium is objectionable, to procure sleep, allay cough, dropsy, palpitation of heart, intermittent fevers, nervousness.

Allied Plants:

1. *Lactuca canaden'sis* (*elonga'ta*), *Wild Lettuce.*—The herb, official 1820–1850; N. America. Herb 1.3–3 M. (4–10°) high, hollow, purple, very leafy, smooth, glaucous; leaves 15–30 Cm. (6–12′) long, pinnatifid; flowers yellow to purple, heads 20–flowered, panicles, rich, damp soil, fields, thickets. Juice from the plant, when in flower, makes good lactucarium, that collected in early season not being bitter.

2. *L. sati'va, Garden Lettuce.*—Juice is medicinal and more abundant in wild than in cultivated plants. Highly valued as salad, and as such acts as a feeble hypnotic. *L. sagitta'ta* (*altis'sima*); large Caucasian plant 2.5–3 M. (8–10°) high, chiefly cultivated in France.

72. COMPOSITÆ. Composite (Thistle) Family.

Kom-poz'i-te. L. *Composit-us* + æ, pp. of *componere,* compounded —*i. e.,* referring to the two kinds of florets (ray and disk) composing each flower-head. Herbs, shrubs. Distinguished by being the largest family, by possessing bitter principles, watery or resinous (rarely milky) sap; flowers (florets) 5's, in compound heads surrounded by involucre; calyx superior, tube adnate to ovary, limb often pappose or membranous; corolla epigynous, usually 5-lobed, stamens 5, epipetalous, syngenesious; ovary inferior, 1-celled; ovule 1, erect; fruit achene; universal; tonic, laxative, anthelmintic (bitter principle), aromatic, carminative, diaphoretic, stimulant (volatile oil).

Genera: **1. Grindelia. 2. Matricaria. 3. Anacyclus. 4. Artemisia. 5. Arnica.**

GRINDELIA. GRINDELIA.

Grindelia { **camporum,** *Greene,*
cuneifolia, *Nuttall,*
squarrosa, (*Pursh*) *Dunal.* } The dried leaves and flowering tops, with not more than 10 p. c. of stems, foreign matter.

Habitat. N. America, west of Rocky Mountains to Texas, Mexico, California; mountain ranges (highlands), salt marshes (lowlands), etc.

Syn. Grindel., California Gum-plant, Tar-weed; Donia squarrosa; Fr. Grindélia; Ger. Grindelie.

Grin-de′li-a. L. after D. H. Grindel, 1776–1836, German botanist and professor at Riga and Dorpat.

Cam-po′rum. L. Gen. pl. fr. *campus*, plain, field, highland—*i. e.*, its habitat.

Cu-ne-i-fo′li-a. L. *cuneifolius*, fr. *cuneus*, a wedge, + *folium*, a leaf—*i. e.*, shape of leaves.

Squar-ro′sa. L. *squarrosus*, scurfy, scaly, full of loose leaves—*i. e.*, the involucre.

PLANTS.—Small, perennial, woody herbs, .3–1 M. (1–3°) high, more or less bushy; stems with attached branches terminated with resinous flower-buds; stems cylindrical, yellowish, pinkish, with alternate leaf-scars and basal portions of leaves, often flexuous and coated with resin. LEAVES, usually separate, broken, lanceolate, oblanceolate-spatulate, cuneate-spatulate, 1–7 Cm. ($\frac{2}{5}$–3′) long, sessile or amplexicaul, sharply serrate, spinosely toothed, yellowish, resinous, coriaceous, brittle; bracts entire, spreading; heads resinous, viscid, many-flowered, conical-urceolate, depressed-urceolate, involucres of many imbricated bracts with recurved tips; ray-florets yellow, ligulate, pistillate; disk-florets yellow, tubular, perfect; pappus of 2–3 mostly unequal linear awns; disk achenes ovoid, oblong, compressed, triquetrous, biauriculate, broadly unidentate, truncate summit; odor balsamic; taste aromatic, bitter, resinous. POWDER, yellowish-brown; microscopically—fragments of stem tissues, tracheæ, wood-fibres, pith cells tubular, with layer of protoplasm and embedded spheroidal granules; fragments of leaf epidermis with polygonal areas, chloroplastids, glandular hairs; pollen grains. *Solvent:* alcohol. Dose, gr. 15–60 (1–4 Gm.).

Commercial.—*G. robusta,* although first used medicinally and still preferred by some physicians, is too scarce for official recognition, while the three accepted are abundant and common; *G. camporum,* often under the name of *G. squarrosa,* from the highlands, contributes most, while *G. cuneifolia*, often under the name of *G. robusta*, from the lowlands, supplies considerable. Should be collected early in full bloom.

CONSTITUENTS.—Resin, Bitter principle 1–2 p. c., Volatile oil, hentriacontane, $C_{31}H_{64}$, phytosterol, phenol, acids, grindeline (bitter, crystalline, soluble in water, alcohol, ether), fixed oil, wax, sugar, caoutchouc, tannin 1.5 p. c., ash 7–8 p. c.

Resin.—This is the active principle, acrid, so abundant as at times to coat over leaves and involucre, thus making them glutinous; hence the name gum-plant.

Bitter Principle (Grindelin).—A glucoside, considered to be a mixture of saponin and another saponin-like glucoside.

Volatile Oil.—This has turpentine odor; quantity very small.

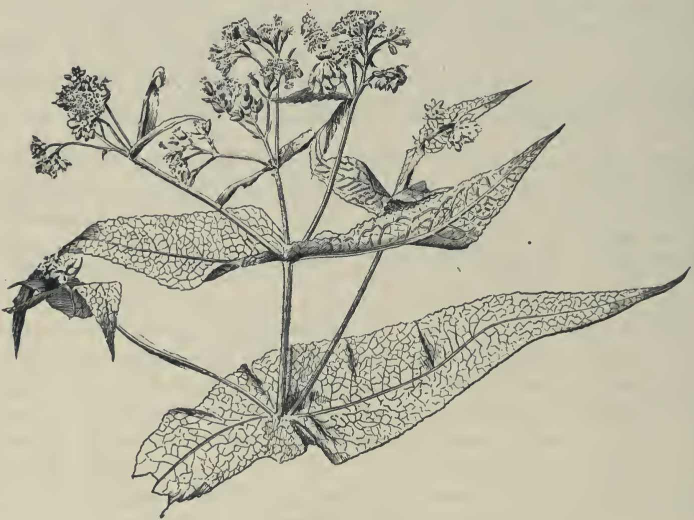


FIG. 415.—*Eupatorium perfoliatum:* flowering top.

PREPARATIONS.—1. *Fluidextractum Grindeliæ.* Fluidextract of Grindelia. (Syn., Fldext. Grindel., Fluid Extract of Grindelia; Fr. Extrait fluide de Grindélia; Ger. Grindelienfluidextrakt.)

Manufacture: Similar to Fluidextractum Sabal, page 95; menstruum: 75 p. c. alcohol. Dose, ♏xv–60 (1–4 Ml. (Cc.)).

Unoff. Preps.: Extract, dose, gr. 5–15 (.3–1 Gm.). *Infusion. Tincture.*

PROPERTIES.—Cardiac sedative, expectorant, antispasmodic, tonic, stomachic, diuretic; relaxes muscular coat of the bronchial tubes; large doses produce narcosis, dilated pupils, impaired power of locomotion, increased urine. Resembles conium somewhat in action, and cases of poisoning should be treated similarly.

USES.—Asthma, bronchitis, whooping-cough, catarrh of bladder and uterus; locally to burns, blisters, rheumatism, and poisoning by rhus toxicodendron; in solution or poultice. It is eliminated by the bronchial mucous membrane and the kidneys, stimulating both, the latter sometimes to the extent of renal irritation.

Allied Plants:

1. *Grindelia glutino'sa* and *G. hirsu'tula.*—W. United States, stem of former often purple, tomentose; both are very similar to and often collected and mixed in with the official.

2. *Eupato'rium perfolia'tum, Boneset, Thoroughwort.*—The dried leaves and flowering tops, official 1820–1910; N. America, swamps, meadows, banks. Hairy perennial, .6–1.2 M. (2–4°) high, branched at summit. Leaves opposite, the pairs united at the base, 8–20 Cm. (3–8′) long, 1.5–5 Cm. (⅗–2′) broad, tapering from base to apex, crenate-serrate, rugosely veined, rough and bright green above, yellowish-gray-green, tomentose, resinous-dotted beneath; flower-heads small, numerous, corymbed, with campanulate involucre of lance-linear imbricated scales, flowers 10–15 tubular yellowish-white florets with bristly pappus in a single row; odor faintly aromatic; taste strongly bitter, astringent; solvents: diluted alcohol, water partially; contains eupatorin, volatile oil, resin, tannin, wax, gum, sugar, yellow coloring matter, ash 7.5 p. c. Stimulant, tonic, diaphoretic (diuretic); large doses emetic, aperient, antiperiodic, similar to chamomile; intermittent fever, rheumatism, influenza, bronchitis. Dose, ʒss–1 (2–4 Gm.); fluidextract (dil. alc.), ♏xv–60 (1–4 Ml. (Cc.)); infusion, 5 p. c., ℥j–2 (30–60 Ml. (Cc.))—when cold tonic, when warm emetic, diaphoretic.

3. *E. purpu'reum, Gravel Root, Queen of the Meadow.*—The root, official 1820–1840; N. America. Perennial herb 1–2 M. (3–6°) high, stem green or purplish, purple band at joints, 2.5 Cm. (1′) wide, leaves petiolate, 3–6 in whorl, 20–25 Cm. (8–10′) long, 10–12.5 Cm. (4–5′) wide, downy beneath, flowers purple to white, corymbs, dry woods, meadows; contains euparin; taste bitter, aromatic; astringent. *E. verbenæfo'lium* (*teucrifo'lium*), *Wild Hoarhound, Rough Boneset;* the herb, official 1820–1840. Perennial hairy herb .6–2.5 M. (2–8°) high; low grounds; leaves ovate, oblong, truncate at base, toothed; flowers Aug., white, panicled corymb, considered by some only a variety of *E. perfoliatum,* all three possessing similar properties. *E. capillifo'lium* (*fœnicula'ceum*), *Dog-fennel, Hog-weed;* Virginia to Florida. Plant smooth, 1–3 M. (3–10°) high; juice relieves pain from insect-bites.

4. *Solida'go odo'ra, Sweet* or *Anise-scented Golden-rod.*—The leaves and tops, official 1820–1880; N. America. Perennial herb, .6–1 M. (2–3°) high, greenish-yellow, pubescent; leaves lanceolate, pellucid-dotted, 2.5–5 Cm. (1–2′) long, 12 Mm. (½′) wide; flowers yellow, racemes; fruit achenes; odor and taste sweet, anise-like, more pronounced when bruised; contains volatile oil. Used for stimulant, rubefacient, anodyne, carminative, diaphoretic, aromatic; hemorrhages, colic, neuralgia, amenorrhœa, rheumatism; infusion, oil. Dose, ʒss–2 (2–8 Gm.); oil, ♏j–5 (.06–.3 Ml. (Cc.)).

5. *Erig'eron canaden'sis, Canada Fleabane, Horseweed, Fireweed.*—The herb, official 1820–1880; the volatile oil distilled from the fresh

flowering herb, official 1880–1910; N. America, fields, waste places; naturalized in other countries. Annual herb, .3–2.5 M. (1–8°) high; stem branching, hairy, furrowed; leaves linear-lanceolate, entire, dentate; flowers small, numerous, white, terminal panicles; contains volatile oil .2–.4 p. c., bitter principle (amaroid), tannin, gallic acid. Oil is a pale yellow liquid, darker and thicker with age and exposure; odor peculiar, aromatic, persistent; taste aromatic, pungent, sp. gr. 0.850; contains *d*-limonene, $C_{10}H_{16}$, terpineol, a substance easily decomposed or polymerized by heat making distillation difficult at ordinary pressure. *Test:* 1. Soluble in equal volume of alcohol (dist. from oil of fireweed, *Erechthi′tes hieracifo′lia,* and oil of turpentine), also in equal volume of glacial acetic acid, which solution with bromine yields crystals of $C_{10}H_{16}Br_4$. Stimulant, tonic, diuretic, diaphoretic, styptic; diarrhœa, dysentery, gravel, dropsy, hemorrhages of uterus and bowels; similar to oil of turpentine, but less irritating and stimulating. First employed by the "Eclectics." Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, gr. 15–60 (1–4 Gm.); decoction, 5 p. c., ℥ss–1 (15–30 Ml. (Cc.)); oil, ♏v–10 (.3–.6 Ml. (Cc.)). *E. an′nuus* (*heterophyl′lus*), *Various-leaved Fleabane, Sweet Scabious;* the herb, official 1830–1880. Biennial herb, 1–1.5 M. (3–5°) high, branched, hairy, leaves sharply, coarsely toothed; flowers Aug., corymbs, rays white tinged with purple, disk yellow; in fields, waste places. *E. philadel′phicus, Philadelphia Fleabane;* the herb, official 1820–1880. Perennial herb, .3–1 M. (1–3°) high, pubescent, slender, leafy; leaves 5–10 Cm. (2–4′) long, 12–18 Mm. (½–¾′) wide, midrib broad, flowers June-Aug., numerous, panicled corymbs, rays 150–200, filiform purplish, disk yellow. Both have same constituents and properties as *E. canadensis.*

6. *Gnapha′lium obtusifo′lium* (*polyceph′alum*), *Common, Sweet,* or *Fragrant Life Everlasting.*—Annual erect herb, .3–1 M. (1–3°) high, woolly, fragrant; leaves lanceolate, undulate, sessile, flowers in heads, clustered at summit of corymbose branches, obovate, whitish involucre, yellow, tubular, odor pleasant, bitter; contains volatile oil and bitter principle. Used for diarrhœa, hemorrhages, externally in fomentation and as a vulnerary to bruises, ulcers, etc. Dose, ʒss–1 (2–4 Gm.).

7. *In′ula Hele′nium, Inula, Elecampane.*—The root, official 1820–1900; C. and S. Europe, C. Asia. Perennial herb, 1–2 M. (3–6°) high; stem thick, solid, striate, villous; leaves large, .3–.5 M. (10–18′) long, 10–20 Cm. (4–8′) wide, ovate, serrate, pubescent beneath, long-petioled, fleshy midrib; flowers large, 6 Cm. (2⅖′) wide, single, golden-yellow. Root, dug in autumn of the second year, 15–30 Cm. (6–12′) long, 18–25 Mm. (¾–1′) thick; usually in transverse, concave slices or longitudinal sections, with overlapping bark, wrinkled, brownish, fracture short, radiate, dotted, with resin-cells, free from starch; odor peculiar, aromatic; taste bitter, pungent; contains volatile oil, acrid resin, bitter principle, inulin, helenin, wax; solvents: alcohol, water partially. Stimulant, diaphoretic, diuretic, expectorant, emmenagogue, tonic; lung diseases, bronchitis, vesical catarrh, amenorrhœa, dyspepsia,

skin affections, dropsy, whooping-cough, diphtheria. Dose, ʒss–1 (2–4 Gm.); decoction, ℥j–2 (30–60 Ml. (Cc.)); fluidextract, ʒss–1 (2–4 Ml. (Cc.)); infusion, 5 p. c., ℥j–2 (30–60 Ml. (Cc.)). *I. squarro'sa;* S. Europe. Leaves tomentose, rugose, ray-florets 3-cleft, tubular; emmenagogue, diuretic, powder burned to repel insects.

8. *Pulica'ria (Inula) dysenter'ica, Fleawort;* used like the preceding. *Carli'na acau'lis*, Europe; contains volatile oil, resin, similar to elecampane in odor, etc.; diaphoretic, diuretic, large doses purgative, typhoid condition, impotence, amenorrhœa, paralysis of the tongue. Dose, gr. 10–20 (.6–1.3 Gm.).

9. *Calen'dula officina'lis, Marigold.*—The dried ligulate florets, official 1880–1910; S. Europe, Levant, cult. as ornament. Annual herb, .3–.6 M. (1–2°) high, angular, roughish-hairy; leaves toothed, oblanceolate; flower-heads terminal, 5 Cm. (2′) broad, involucre flattish, hemispherical, 2-rowed; disk-florets many, tubular, 5-cleft, yellow. Ligulate (ray)-florets, one or several rows, 15–25 Mm. ($\frac{3}{5}$–1′) long, 3–6 Mm. ($\frac{1}{8}$–$\frac{1}{4}$′) broad, yellowish, 1–3-toothed, the short hairy tube occasionally enclosing remnants of a filiform style and bifid stigma, without pappus; odor slight, somewhat heavy; taste slightly bitter, faintly saline; solvents: alcohol, boiling water partially; contains volatile oil, bitter principle, calendulin (analogous to bassorin), fat, resin, sugar, gum. Stimulant, tonic, febrifuge, anthelmintic, resolvent; jaundice, amenorrhœa, scrofula, low fevers, vomiting; cancer, ulcers, wounds, otitis. Dose, gr. 15–60 (1–4 Gm.); fluidextract (alcohol); tincture, 20 p. c. (alcohol), ʒss–2 (2–8 Ml. (Cc.))—Homeopathic remedy instead of tincture of arnica or myrrh.

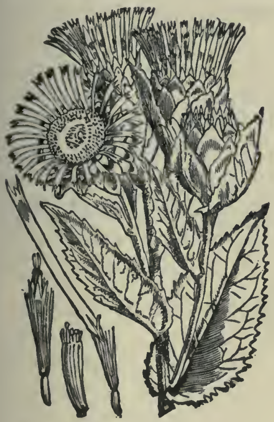


FIG. 416.—*Inula Helenium.*

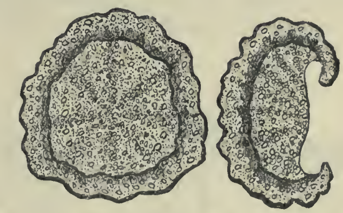


FIG. 417.—Inula: transverse section, natural size.

10. *Brauner'ia pal'lida, Echinacea, Pale purple Cone-flower*, C. and S. United States.—Perennial herb, stem simple, naked above, single large head, leaves alternate, 3–5-nerved. Dried rhizome and roots—cylindrical, 10–20 Cm. (4–8′) long, 4–13 Mm. ($\frac{1}{6}$–$\frac{1}{2}$′) thick, nearly entire, brownish, annulate, V-shaped stem scars, wrinkled, fracture short, fibrous; bark about 1 Mm. ($\frac{1}{25}$′) thick, rhizome with circular pith; odor faint, aromatic taste sweetish, tingling, like aconite, without benumbing; contains acrid resin (activity) 1 p. c., alkaloid. Diaphoretic, sialagogue, alterative; syphilitic and strumous conditions,

chronic ulcers; Sioux Indians used fresh scraped root for hydrophobia, snake-bites, septicemia. Dose, gr. 15–30 (1–2 Gm.).

11. *Achille'a Millefo'lium, Yarrow, Milfoil.*—The leaves and flowering tops, official 1860–1880; N. America. Perennial herb, .3–.6 M. (1–2°) high, hairy; leaves lanceolate, glandular beneath, 5–25 Cm. (2–10′) long, twice pinnatifid, segments toothed; flowers Aug., corymbs, receptacle flat, chaffy, ray-florets white, pistillate; disk white, perfect; fruit achenes, chamomile odor, taste bitter, aromatic; contains volatile oil, achilleine, resin, tannin. Used as stimulant, tonic, emmenagogue; amenorrhœa, menorrhagia, piles, leucorrhœa, colic, relaxed throat, sore nipples, intermittents; infusion, expressed juice. Dose, ℥ss–1 (2–4 Gm.); oil, ♏v–15 (.3–1 Ml. (Cc.)).

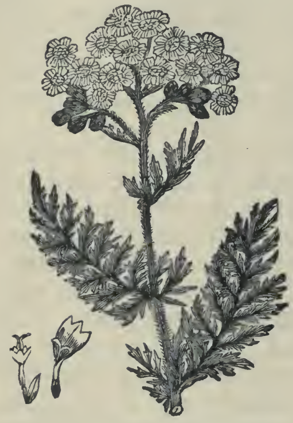


Fig. 418.—*Achillea Millefolium.*

12. *An'themis no'bilis, Roman Chamomile.*—The dried flower-heads of cultivated plants, official 1820–1910; S. and W. Europe. Perennial herb, 15–30 Cm. (6–12′) high, hairy; leaves bipinnatisect, hairy. Flowers, 18 Mm. ($\frac{3}{4}'$) broad, subglobular, consisting of imbricated involucre, many white, 3-toothed ray-florets and a few tubular disk-florets inserted upon chaffy, conical, solid receptacle; odor agreeable; taste aromatic, bitter; solvents: alcohol, hot water; contains volatile oil 1 p. c., anthemic acid (bitter principle), anthemene (anthemidin), resin 5.25 p. c., tannin, fixed oil. Stimulant (volatile oil), tonic (anthemic acid), carminative, nervine, emmenagogue; warm infusion—

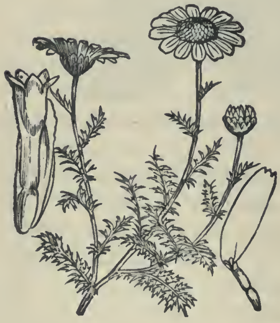


Fig. 419.—*Anthemis nobilis:* wild.

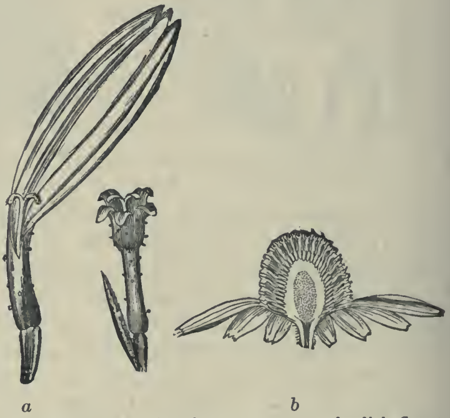


Fig. 420.—Anthemis: *a*, ray- and disk-floret, magnified 4 diam.; *b*, section through single flower-head, natural size.

emetic; cold infusion—tonic; large doses emetic, cathartic; intermittents, torpid liver, delirium tremens, dyspepsia (masticatory); externally—colic, toothache, earache, rheumatism, ulcers, sprains (poultice with vinegar, laudanum); oil—rheumatism, flatulent colic. Dose, gr. 15–60 (1–4 Gm.); fluidextract, ʒss–1 (2–4 Ml. (Cc.)); infusion (best form), 5 p. c., ℥j–2 (30–60 Ml. (Cc.)); oil, ♏j–5 (.06–.3 Ml. (Cc.)). *A.* (*Maru'ta*) *Cot'ula, Mayweed;* the herb, official 1820–1880; N. America. Annual plant in fields, roadsides, .3–.6 M. (1–2°) high, greenish, furrowed, leaves thrice pinnatifid; flowers June–Sept., receptacle solid, conical, chaffy, ray-florets white, disk yellow; contains volatile oil, valeric acid, fat, tannin, anthemidine (?), anthemic acid. Used as stimulant, antispasmodic, sudorific, emmenagogue, vesicant for hysteria, colic, dysmenorrhœa; in infusion. Dose, ʒss–2 (2–8 Gm.).

MATRICARIA. MATRICARIA.

Matricaria Chamomilla, *Linné.* { The dried flower-heads, with not more than 5 p. c. of stems, foreign matter.

Habitat. Europe, W. Asia, naturalized in Australia; cultivated in German settlements in the United States—common road-side weed.

Syn. Matricar., German Chamomile, Wild Chamomile, Camomile, Horsegowan, Dog's Chamovyne; Fr. Fleurs de Chamomille commune (d'Allemagne); Ger. Flores Chamomillæ, Kamillen.

Mat-ri-ca'ri-a. L. fr. *matrix, matrice,* the womb—*i. e.,* its supposed effect on that organ; name used by the medieval pharmacists.

Cham-o-mil'la, better *Camomilla.* L. fr. Gr. *χαμαί,* on the earth, + *μῆλον,* an apple, lit. "earth apple"—*i. e.,* from odor of the bruised plant and flowers (Dioscorides).

Plant.—Annual herb; stem .3–.6 M. (1–2°) high, branched, smooth, solid, striate, pale green; leaves 5 Cm. (2′) long, lower tripinnate, upper bipinnate, green, smooth; leaflets linear, small. Flowers, May–Aug., composed of a few white ray-florets and numerous yellow disk-florets on a conical hollow receptacle, 3–10 Mm. ($\frac{1}{8}$–$\frac{2}{5}$′) broad; disk-florets tubular, perfect, without pappus; ray-florets 10–20, pistillate, corolla white, 3-toothed, 4-veined, usually reflexed; involucre hemispherical, composed of 20–30 imbricated, oblanceolate, pubescent scales; peduncles greenish, longitudinally furrowed, somewhat twisted, 2.5 Cm. (1′) long; achenes obovoid, faintly 3–5-ribbed; pappus none, or only slight membranous crown; odor pleasant, aromatic; taste aromatic, bitter. Should be kept in tightly-closed containers and guarded against insect attack. *Solvents:* boiling water; alcohol. Dose, gr. 15–60 (1–4 Gm.).

Adulterations.—*Anthemis arvensis* and *A.* (*Maruta*) *Cotula* have very similar flower-heads, but receptacles conical, solid, chaffy; also *Santolina* species.

Constituents.—Volatile oil .25 p. c., Anthemic acid, anthemidin (tasteless, crystalline), extractive, tannin, malates, ash 13 p. c.

Volatile Oil.—Obtained by distilling entire plant or flowers; dark blue liquid, due to azulene, sp. gr. 0.940, soluble in alcohol; consists of a paraffin-like body, terpene, $C_{10}H_{16}$, and a colorless oil, anthemol, $C_{10}H_{16}O$. An artificial oil is used in Germany (flowers (480) + oil of lemon (1), distilled with water); it is deep blue, more limpid, and changes color easier than the pure oil. Dose, ♏j–5 (.06–.3 Ml. (Cc.)), on sugar, in pill or ether.

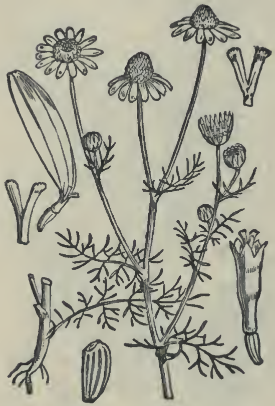


Fig. 421. — *Matricaria Chamomilla.*

Preparations. — (Unoff.): *Infusion,* 5 p. c., when cold a tonic, when warm an emetic. Dose, *ad libitum. Oleum Chamomillæ Infusum* (flowers (10), olive oil (100), digested 2 hours). Used externally. *Syrup* (flowers 3 parts, water for infusion 10, + sugar 18). *Poultice.*

Properties.—Stimulant (volatile oil), tonic (anthemic acid), carminative, diaphoretic, nervine, emmenagogue, antispasmodic, anthelmintic, less agreeable than *Anthemis nobilis,* but may be substituted for it.

Uses.—Warmth to stomach, to aid digestion in convalescence, general debility, intermittents, delirium tremens, flatulent colic; externally—local pains, intestinal and uterine colic, toothache, earache, abscesses, sprains, rheumatism.

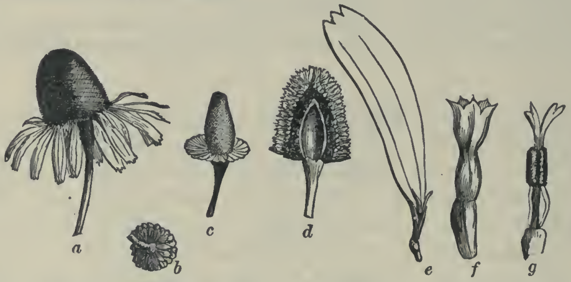


Fig. 422.—Matricaria: *a,* flower-head; *b,* involucre; *c,* receptacle and involucre; *d,* longitudinal section of receptacle, with disk-florets; *e,* ray-floret; *f,* disk-floret; *g,* stamens and style of disk-floret.

PYRETHRUM. PYRETHRUM.

Anacyclus Pyrethrum, (*Linné*) *De Candolle.* } The dried root.

Habitat. N. Africa, Algeria, Barbary—high lands; cultivated in gardens.

Syn. Pyreth., Pellitory Root, Pellitory (of Spain), Spanish Chamomile, Alexander's Foot, Radix Pyrethri Romani; Fr. Pyrethre d'Afrique, Salivaire; Ger. Römische Bertramwurzel.

An-a-cy'clus. L. abr. fr. *Ananthocyclus,* old generic name, fr. Gr. ἀ, not, + ἄνθος, a flower, + κύκλος, a circle—*i. e.,* the outer circlet of ovaries being without flowers.

Py-re'thrum. L. fr. πῦρ (εθρον), fire—*i. e.,* roots spicy taste, feverfew.

Pel'li-tory. Corrupt. of *parietary,* L. *parietaria,* the wall plant, *paries,* a wall—*i. e.,* grows on walls.

Plant.—Procumbent perennial, resembling chamomile; stems numerous, trailing at base, erect in the upper portion, .3 M. (1°) high, terminated by 1 large flower; leaves doubly pinnate, segments linear, pale green, hairy or glabrous; flowers April–June, terminal heads, 2.5–4 Cm. (1–1$\frac{3}{5}$′) wide; rays white above, reddish-purple below and on edges, disk wide, yellow; fruit compressed, obovate, achene smooth, with narrow wing and pappus. Root, nearly cylindrical, slightly tapering, usually in pieces 2.5–10 Cm. (1–4′) long, 5–20 Mm. ($\frac{1}{5}$–$\frac{4}{5}$′) thick, dark brown, deeply longitudinally furrowed, somewhat wrinkled, occasionally with short, tough, hair-like rootlets, crown more or less annulate, sometimes tufted with coarse fibres or long, soft-woolly hairs; fracture short; bark dark brown with 1–2 circular rows of resin ducts, closely adhering to the light yellow, radiate, porous wood, in the medullary rays of which occur 1–3 rows of resin ducts; odor distinct; taste sweetish, pungent, very acrid, tingling and producing strong sialagogue effect. Powder, brownish; microscopically—numerous spherical granules or irregular masses of inulin, not affected by iodine T. S., lignified fragments of woody tissues, stone cells, cork, tracheæ, wood parenchyma. Should be kept in tightly-closed containers, adding occasionally a few drops of chloroform or carbon tetrachloride to prevent insect attack. *Solvents:* alcohol; boiling water partially. Dose, ʒss–1 (2–4 Gm.).

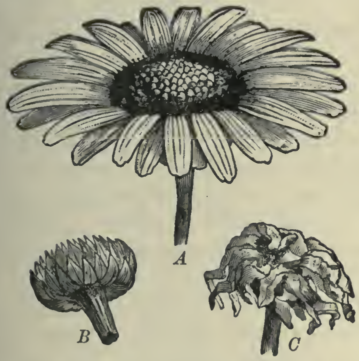


Fig. 423. — *Anacyclus Pyrethrum: A*, expanded flower; *B*, involucre seen from below; *C*, dried flower.

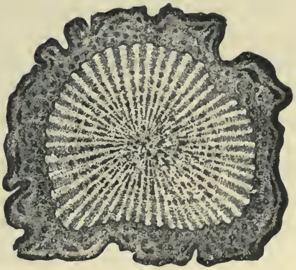


Fig. 424.—Pyrethrum: transverse section, magnified 3 diam.

Commercial.—Plant has been cultivated sparingly, as a garden flower, in Europe since 1570; root should be collected in autumn, and comes solely from Algeria, via Oran and Algiers, or via Tunis, thence to Leghorn, Egypt, from whence much is exported to India, although sometimes called Pellitory of Spain, very little comes from that country.

Constituents.—Pyrethrine, brown acrid resin (containing pellitorin), 2 potassa-soluble acrid fixed oils (one brown, the other yellow), inulin 50 p. c., tannin, volatile oil, gum, ash 3–5 p. c.

Pyrethrine.—This alkaloid is believed to contribute most of the activity; it is decomposed by alcoholic solution of potassium hydroxide into piperidine and pyrethric acid, resembling piperic acid.

Preparations.—1. *Tinctura Pyrethri.* Tincture of Pyrethrum. (Syn., Tr. Pyreth., Tincture of Pellitory; Fr. Teinture de Pyrèthre; Ger. Bertramwurzeltinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 101; menstruum: alcohol. Dose, ʒss–2 (2–8 Ml. (Cc.)).

Unoff. Preps.: Decoction. Fluidextract, dose, ʒss–1 (2–4 Ml. (Cc.)). *Extract* (alcoholic). *Gargle;* all mostly used externally. *Masticatory.*

Properties.—Irritant, rubefacient, sialagogue, sternutatory. When chewed have prickling sensation in the tongue and fauces, with heat, acridity, pungency, copious flow of saliva and mucus; large doses may cause bloody diarrhœa, quick pulse, spasms, stupor; stimulation is due to direct irritation of nerve-ends locally, which soon depresses nerves and blunts their sensibility.

Uses.—Administered by mastication; headache, rheumatism, neuralgia, toothache, paralysis of tongue or throat, relaxed uvula, chronic catarrh; alcoholic tincture or extract, as an anæsthetic in carious teeth.

Allied Plants:

1. *Anacyclus officina'rum, German Pellitory.*—Cultivated in Saxony, Bohemia, Prussia, near Magdeburg, and is considered to be the annual form of the official plant; root 6 Mm. ($\frac{1}{4}'$) thick, smaller than official, bark thick with 1 circle of resin-cells, medullary rays without resin-cells.

2. *Chrysan'themum* (*Pyrethrum*) *ro'seum* and *C. car'neum, Persian Pellitory—Persian* (*Caucasian*) *Insect Powder;* W. Asia, Persia. Perennial plants, resembling chamomile; flower-heads 4 Cm. ($1\frac{3}{5}'$) broad; ray-florets rose-color with anthers included (*roseum*), or purple with anthers projecting (*carneum*); used only for killing insects, the toxicity being due to pyrethron (pyrethrotoxic acid—cardiac depressant like veratrine), a neutral, amber-yellow syrupy ester (pyretol) soluble in alcohol, ether, splitting into pyrethrol, $C_{21}H_{34}O$, and several acids, pyrethresin.

3. *C. cinerariæfo'lium, Dalmatian Insect Powder;* Dalmatia. These flowers are most valuable when collected immediately after expansion, and yield a more or less inferior insect powder. *Tests:* 1. Put 4 gr. (.25 Gm.) of the powder upon a fly in a vial—it should be stupefied in 1 minute and dead in 2 or 3 minutes. 2. With microscope can recognize scarcity of pollen and abundance of collenchymatous tissue when much stem and few flowers are used. Powder often adulterated with turmeric (chloroform test), chrome alum (ash not more than 6 p. c.), and other compositous plant flowers, as *Chrysanthemum Leucan'themum* (*Leucanthemum vulga're*), white-weed, oxeye or field daisy, and *C. seg'etum.* Neither of these is an insecticide, but will produce dermatitis in some persons.

4. *Tanace'tum vulga're, Tanacetum, Tansy.*—The leaves and tops, official 1820–1900; Europe, Asia. Perennial herb, .6–1 M. (2–3°) high; stem obscurely hexagonal, striated, often reddish; root fibrous,

many-headed; flowers yellowish discoid, dense, terminal corymbs; fruit achene, small, oblong, 5–6 ribs, crowned with pappus. Leaves, 15 Cm. (6′) long, bipinnatifid, segments obtuse, oblong, serrate, glandular, receptacle convex, naked, florets tubular; odor strong, aromatic; taste pungent, bitter; contains volatile oil .25 p. c., tanacetin, fat, resin, tannin, mucilage; solvents: alcohol, water. Stimulant, tonic, emmenagogue, anthelmintic, diuretic, narcotic; large doses cause vomiting, convulsions, coma, mydriasis, feeble respiration and pulse, death from paralytic asphyxia. Used in intermittents, hysteria, amenorrhœa, colic, abortifacient; locally for bruises, sprains, rheumatism, ulcers. Dose, gr. 15–60 (1–4 Ml. (Cc.)); fluidextract, ♏xv–60 (1–4 Ml. (Cc.)); infusion, 5 p. c., ℥j–2 (30–60 Ml. (Cc.)); oil, ♏j–5 (.06–.3 Ml. (Cc.)).

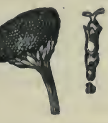


Fig. 425.—*Tanacetum vulgare:* flower; *a*, single flower.

5. *T. vulgare* var. *cris′pum*, *Double Tansy.*—Leaves twice pinnatifid, curled. *T. Balsam′ita* (*Pyrethrum Tanacetum*), S. Europe; odor strong, taste bitter. Both often cultivated and used similar to *T. vulgare.*

SANTONICA. SANTONICA.

Santoninum. Santonin, $C_{15}H_{18}O_3$, *official.*

Artemisia pauciflora, *(Ledebour) Weber.* } The inner anhydride (lactone) of santonic acid.

Habitat. N. Turkestan, Russia, on the vast plains of Kirghiz.

Syn. Levant Wormseed, Aleppo, Alexandria or European Wormseed, Tartarian Southern Wood, Semen Santonici—Cinæ—Sanctum—Contra; Anhydrous Santoninic Acid; Fr. Semen-contra d'Alep, Barbotine; Santonine, Lactone santonique; Ger. Flores Cinæ, Wurmsamen, Zittwersamen; Santonin.

Ar-te-mis′i-a. L. fr. Gr. Ἄρτεμις, the goddess; Roman Diana, to whom *Artemisia Absinthium* was dedicated, owing to its use in hastening puberty.

Pau-ci-flo′ra. L. *paucus*, few, + *florus*, flower—*i. e.*, has few blooms, mostly only buds.

San-ton′i-ca. L. *santonicus*, pertaining to the Santoni, people of Aquitania (Gr. σαντονικόν, their wormwood), named in commemoration, which name survives to the place Saintes, in France.

Plant.—Small, semi-shrubby perennial, with knotty, fibrous rootstocks, branching from crown, from which many erect, flowering stems arise, .3 M. (1°) high; stems 6–8, woolly or glabrous, at first leafy; leaves bipinnatisect, 12 Mm. ($\frac{1}{2}$′) long, woolly when young, afterward grayish. Flowers, 2–4 Mm. ($\frac{1}{12}$–$\frac{1}{6}$′) long, 1 Mm. ($\frac{1}{25}$′) wide, oblong-ovoid, slightly flattened, obtuse, smooth, glossy, grayish-green, after exposure to light brownish-green, consisting of an involucre of 12–18 closely imbricated, glandular scales, with broad midribs, enclosing 4–5 rudimentary florets; odor strong, peculiar, camphoraceous; taste aromatic, bitter. *Solvents:* diluted alcohol; hot water partially. Dose, gr. 15–60 (1–4 Gm.).

Constituents.—Santonin 1–2 p. c., Volatile oil 2–3 p. c., artemisin, $C_{15}H_{18}O_4$ (in santonin mother-liquor, recrystallizing pure from chloroform), resin, gum, ash 7 p. c.

Santoninum. Santonin.—Discovered in 1830, and may be obtained by mixing powdered santonica (5) with slaked lime (1), exhausting with hot water, concentrating filtered solution containing calcium santonate, decomposing with hydrochloric acid, giving calcium chloride in solution, and santonin precipitated along with resinous matter, from which freedom may be obtained by washing with dilute ammonia water, or recrystallizing from hot alcohol. It is in colorless, shining, flattened rhombic prisms, crystalline powder, odorless, nearly tasteless at first, afterward developing bitterness, permanent; yellow on exposure to light, which may be converted into colorless crystals by recrystallization from alcohol, soluble in alcohol (43), boiling alcohol (6.5), chloroform (1.7), ether (110), slightly in water or boiling water; solutions neutral, lævorotatory, melts at 170° C. (338° F.). *Tests:* 1. Heat .5 Gm. with 5 Ml. (Cc.) of alcoholic potassium hydroxide T. S.—red color; incinerate 1 Gm.—ash .1 p. c. 2. Shake .01 Gm. with a cooled mixture of sulphuric acid and distilled water, each 1 Ml. (Cc.), heat to boiling, add trace of very dilute solution of ferric chloride—violet color. *Impurities:* Alkaloids, readily carbonizable organic substances. Should be kept dark, in well-closed containers. Dose, gr. 1–4 (.06–.26 Gm.); child, gr. $\frac{1}{4}$–1 (.016–.06 Gm.).

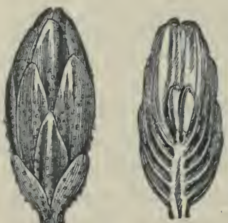


FIG. 426. — Santonica: head and longitudinal section, magnified 10 diam.

Volatile Oil.—Obtained by distilling with water or steam; yellowish, disagreeable odor; consists mainly of cineol, $C_{10}H_{18}O$, some dipentene, sp. gr. 0.930, when shaken with iodine get greenish crystals.

ADULTERATIONS.—SANTONICA: Mustard hulls (large brown fragments recognized by microscope), exhausted birch bark. SANTONIN: Salicin, boric acid, strychnine, picric acid. With sulphuric acid at first colorless (abs. of salicin, which turns red). Boric acid insoluble in chloroform, non-volatile—green color to alcohol flame, and heated upon foil—glassy mass, the solution of which turns turmeric paper brown. Picric acid—explodes by heat or percussion; forms yellow salts and precipitates gelatin in aqueous solution.

Commercial.—The source *Artemisia marit'ima* var. *pauciflora* is preferred by some writers, although it has escaped far from its original maritime habitat. Flowers exposed to light and air soon become brown and inactive, hence should be preserved in tight containers. There are two varieties: 1, *Aleppo, Alexandria, Levant,* collected July–August, forwarded to the great fair of Nizhnee-Novgorod, and thence to market via Moscow, Petrograd (St. Petersburg), W. Europe; 2, *Barbary* (*A. Siebe'ri,* + *A. ramo'sa*), rarely met here, as it (flower-heads) does not contain santonin.

PREPARATIONS.—(Unoff.) I. FLOWER-HEADS: *Electuary. Extract. Infusion.* II. SANTONIN: *Trochisci Santonini,* $\frac{1}{2}$ gr. (.03 Gm.), official 1890–1910, dose, 1–4 troches. *Trochisci Santonini Compositi,* santonin, mild mercurous chloride, each $\frac{1}{2}$ gr. (.03 Gm.), dose, 1–2 troches.

COMPOSITÆ

Sodii Santoninas, official 1880–1890, dose, gr. 2–10 (.13–.6 Gm.). *Trochisci Sodii Santoninatis,* official 1880–1890 (1 gr.; .06 Gm.), dose, 1–4 troches. *Santoninic Acid,* dose, gr. 1–4 (.06–.26 Gm.).

PROPERTIES.—Anthelmintic, stimulant, emmenagogue. The Crusaders introduced santonica into Europe, and it has been used there ever since, mostly now as santonin. It is absorbed as sodium santoninate, and eliminated by the kidneys; large doses dilate pupils, cause gastric oppression, nausea, vomiting, diarrhœa, thirst, cold, clammy skin, giddiness, cerebral congestion, yellow vision (xanthopsia) changing to purplish-red, convulsions, death. Santonin in gr. 5 (.3 Gm.) doses is a strong diuretic, imparting to normal acid urine a saffron color (as does rhubarb), which, by age, hence alkalinity, becomes violet-purple. A child 5 years old was killed by gr. 2 (.13 Gm.).

USES.—For round worms (*Ascaris lumbricoides*), sometimes for thread-worms (*Oxyu'ris vermicula'ris*), but never for tape-worm. Santonin kills the round worms that inhabit the small intestine; therefore, purgatives having specific action here should be selected. Give the powder in honey, molasses, to which calomel or jalap has been added, at bedtime, having fasted that day; follow this next morning, before food, with a draught of senna or a dose of castor oil; a suppository is serviceable for thread-worms; may reserve entire cathartic until next morning if desirable. Useful in incontinence of urine, eye affections due to inflammatory changes of optic nerve and retina. Never give to children with fever nor while constipated, owing to possible toxic results, which are combated by ammonia, strychnine, eliminants, artificial respiration.

Allied Products:

1. *Barbary Wormseed* (*A. ramo'sa*).—N. W. Africa. Unexpanded flower-heads are rounder than those of *Artemisia pauciflora,* being covered with whitish down, by which they may readily be recognized.

2. *Indian Wormseed.* — Europe. Only half size of santonica, hairy and more yellow. The American wormseed are often substituted for santonica, but their resemblance, on close inspection, is very slight.

Allied Plants:

1. *Artemisia Absin'thium, Absinthium, Wormwood.*—The dried leaves and flowering tops, official 1840–1900; Europe, N. Asia, N. Africa. Perennial herb; stem .6–1 M. (2–3°) high. Leaves, 2.5–7.5 Cm. (1–3′) long, hoary, grayish-green; flowers, in heads, racemose, subglobose, with involucre, receptacle convex, hairy, florets yellow; fruit achene, obovoid without pappus; odor aromatic; taste very bitter; contains volatile oil 1 p. c., absinthin, anabsinthin, tannin, resin, absinthic (succinic)

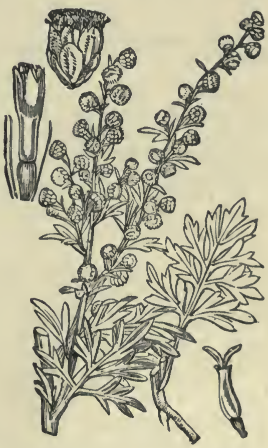


FIG. 427.—*Artemisia Absinthium.*

acid, salts, ash 7 p. c. Tonic, stomachic, stimulant, febrifuge, anthelmintic; used for atonic dyspepsia, lumbricoid worms; oil in form of *absinthe liqueur* (oil + anise oil + alcohol) as a narcotic, stimulant in cerebral exhaustion, alone locally as an anæsthetic for rheumatism, neuralgia. Dose, gr. 15–60 (1–4 Gm.); infusion, 5 p. c., ℥j–2 (30–60 Ml. (Cc.)); tincture (diluted alcohol), 20 p. c., ʒj–2 (4–8 Ml. (Cc.)).

2. *A. Abrot'anum, Southern-wood, Old Man.*—Asia, Europe; hairy, segments of the pinnatifid leaves capillaceous, lemon odor. *A. vulga'ris, Mugwort,* Africa, Europe, spontaneous in United States; stem purple; epilepsy, amenorrhœa. *A. gnaphalo'des* (*A. Ludovicia'na* var. *gnaphalodes*), *Western Mugwort,* Mich. to Oregon; febrifuge. *A. abyssin'ica,* Abyssinia; has woolly involucre, whitish florets; aromatic odor.

3. *Tussila'go Far'fara, Coltsfoot, Coughwort,* Europe, N. Asia, nat. in N. United States.—Low succulent perennial, creeping annulate rhizome, scaly scapes in spring, bearing a single head; flowers yellow. Leaves petioled, pubescent, orbicular 8–15 Cm. (3–6') long and broad, cordate, angulately lobed, dentate, red-brown teeth, palmately 5–9-veined; odor distinct, taste mucilaginous, herbaceous, bitter; contains glucoside (bitter), resin, tannin, volatile oil, gum, wax, caoutchouc, ash 20 p. c. Demulcent, toxic; bronchitis, pulmonary affections, coughs. Dose, gr. 30–60 (1–2 Gm.); decoction, infusion, 5 p. c. ℥ss–1 (15–30 Ml. (Cc.)); expressed juice; dried root as well as leaves smoked for cough; popular domestic remedy.

ARNICA. ARNICA.

Arnica montána, *Linné.* } The dried flower-heads.

Habitat. Europe—Germany, Switzerland (Alps, Pyrenees)—N. Asia, N. W. America; in mountains and moist upland meadows.

Syn. Arnic., Arnica Flowers, Leopard's-bane, Wolf's-bane, Mountain Arnica or Tobacco; Br. Arnicæ Flores; Fr. Fleurs (d'Arnique) d'Arnica; Ger. Flores Arnicæ, Arnikablüten, Fallkraut, Wohlverleich (blüten).

Ar'ni-ca. L. fr. Gr. *ἀρνάκις*, a sheep's skin—*i. e.*, resemblance of hairy stem and leaves; or from *πταρμικ[ός ἡ]*—*i. e.*, causing one to sneeze.

Mon-ta'na. L. *montanus*, mountainous, from its preferred place of growth.

Plant.—Perennial herb; stem .3 M. (1°) high, hairy, striate; leaves—radical oblong-ovate, entire, ciliated, obtuse—cauline lanceolate, both kinds bright green, pubescent; rhizome 5 Cm. (2') long, 2–4 Mm. ($\frac{1}{12}$–$\frac{1}{6}$') thick, brown, wrinkled, internally whitish, bark thick, under surface with numerous roots, fragile, 10 Cm. (4') long; achenes crowned with hairy pappus. Flowers, May–June, subglobular, yellowish-brown, 2.5–5 Cm. (1–2') broad, 2 Cm. ($\frac{4}{5}$') long, consisting of disk- and ray-florets, occasionally with involucre and receptacle; involucral bracts narrowly lanceolate, 1 Cm. ($\frac{2}{5}$') long, dark green, pubescent; receptacle slightly convex, deeply pitted, densely short-hairy; ray-florets bright yellow; ligulate portion 2 Cm. ($\frac{4}{5}$') long, often folded lengthwise, 3-toothed, 7–12-veined, pistillate; disk-florets (tubular) perfect, reddish-yellow, stamens without tail-like appendage (dist. from *Inula Helenium*—with 2 bristles or long tails at the base); achenes fusiform, 5–7 Mm. ($\frac{1}{5}$–$\frac{1}{3}$′) long, brown, striate, glandular-pubescent, long pappus of barbellate bristles; odor characteristic, agreeable; taste bitter, acrid. POWDER, yellowish-brown—many spinose pollen grains, non-glandular hairs (3 kinds), glandular hairs (3 kinds), pappus of multicellular axis with unicellular branches. *Solvents:* diluted alcohol; hot water. Dose, gr. 5–20 (.3–1.3 Gm.).

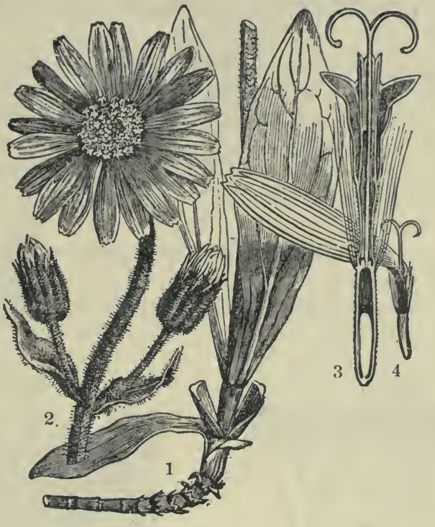


FIG. 428.—*Arnica montana:* *1*, rhizome and stem; *2*, flowering stem; *3*, vertical section of disk-flower; *4*, ray-floret.

ADULTERATIONS.—FLOWERS: Flowers of many Compositæ—*Calendula*, *Anthemis* (both without pappus), *Inula*, *Doron'icum*, *Sene'cio* (naked receptacle), *Scorzone'ra*, and *Tragopo'gon* (florets all ligulate); POWDER: Curcuma—recognized by starch grains; chrome alum—increases ash.

Commercial.—Flowers used mostly in medicine, lose 75 p. c. on drying and in Germany are deprived of involucre and receptacle, because these parts often are attacked by larva of the arnica-fly (*Trype'ta arniciv'ora*), an insect which should always be removed when found.

CONSTITUENTS.—Arnicin, $C_{12}H_{22}O_2$, 4 p. c., volatile oil .04–.07 p. c., resin, fat, salt, arnidiol (phytosterol), ash 6–9 p. c.

Arnicin.—A glucoside obtained by passing tincture through animal charcoal, evaporating, adding to residue ether, which dissolves arnicin and fat, and this shaken with alcohol dissolves out arnicin. It is yellow, amorphous, acrid taste, soluble in alcohol, ether, alkalies (NH_4OH, KOH, $NaOH$, $NaHCO_3$), slightly in water.

PREPARATIONS.—1. *Tinctura Arnicæ.* Tincture of Arnica. (Syn., Tr. Arnic., Tinctura Arnicæ Florum; Fr. Teinture d'Arnica; Ger. Tinctura Arnicæ, Arnikatinktur.)

Manufacture: 20 p. c. Moisten 20 Gm. with diluted alcohol 50 Ml. (Cc.), transfer to percolator without pressing, let stand, well-covered, for 24 hours, pack with moderate pressure, percolate to 25 Ml. (Cc.), stop flow, macerate for 24 hours, percolate to 50 Ml. (Cc.), stop flow, macerate for 12 hours, percolate to 75 Ml. (Cc.), stop flow, macerate for 12 hours, percolate q. s. 100 Ml. (Cc.). If ammonia water ʒj to Oij (4 Ml. (Cc.)—1 L.) be added to the first macerating menstruum, a much darker-colored preparation is obtained, which is equally efficient. Dose, ♏xv–45 (1–3 Ml. (Cc.)).

Unoff. Preps.: FLOWERS: *Extract,* dose, gr. 1–3 (.06–.2 Gm.). *Fluidextract* (dil. alc.), dose, ♏v–20 (.3–1.3 Ml. (Cc.)). *Infusion,* dose, ℥ss–1 (15–30 Ml. (Cc.)). *Fomentation.* RHIZOME: *Decoction,* 5 p. c., dose, ʒiv (15 Ml. (Cc.)). *Extract* (diluted alcohol), dose, gr. 1–3 (.06–.2 Gm.). *Fluidextract* (75 p. c. alcohol), dose, ♏v–10 (.3–.6 Ml. (Cc.)). *Tincture,* 10 p. c. (65 p. c. alcohol), dose, ♏v–20 (.3–1.3 Ml. (Cc.)). *Plaster.*

PROPERTIES.—Stimulant, tonic, carminative, diuretic, nervine, emmenagogue, irritant, sternutatory, vulnerary; large doses emetic, cathartic, causing abdominal pains, headache, collapse, resembling aconite.

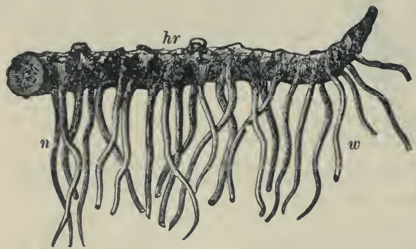


FIG. 429.—*Arnica montana: hr,* rhizome; *n-w,* roots.

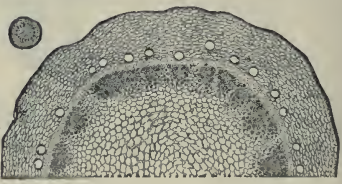


FIG. 430.—Arnica: transverse section of rhizome, natural size, and magnified 12 diam.

USES.—Typhoid condition, brain concussion, intermittents, dysentery, diarrhœa, gout, nephritis, rheumatism, dropsy, amaurosis, chlorosis, amenorrhœa, chronic catarrh, paralysis, nervous affections. The natives of Savoy and the Vosges use the flowers and leaves as a substitute for tobacco. Locally in paralysis, sprains, bruises, abrasions, hence the German name Fallkraut, accident plant. Atropine best antidote.

Allied Plants:

1. *Arnica folio'sa, A. alpi'na,* and *A. Chamisso'nis.*—California to Maine. These have flowers closely resembling the official.

2. *Senec'io au'reus, Life Root, Ragwort, Squaw-weed,* Eastern N. America. Perennial herb, .3–.6 M. (1–2°) high, stem nearly smooth, flooted; rhizome short, resembling arnica, rosette of basal leaves, each rounded, 5–7 Cm. (2–3′) broad, crenate-dentate, stem leaves smaller, narrower, pinnatifid, sessile, creeping; few heads, yellow,

corymb, involucral scales in 2 series, pappus of white bristles; odor characteristically aromatic, taste bitter, astringent, acrid, pungent; contains volatile oil, resin, bitter principle (senecin), tannin. Stimulant, diüretic, emmenagogue, vulnerary; atonic conditions, amenorrhœa, dysmenorrhœa. Dose, ʒss–1 (2–4 Gm.); decoction, infusion, 5 p. c., ℥j–2 (30–60 Ml. (Cc.)); dried overground portions used; popular with Eclectics, Homeopaths, American Indians.

3. *Arc'tium Lap'pa, Burdock, Clotbur.*—The dried root, collected from plants of the first year's growth, official 1830–1910; Europe, N. Asia, nat. in N. America, waste places. Coarse biennial weed, .6–2 M. (2–6°) high, branched; leaves cordate-oblong, dentate, rough, petiolate; flowers purple, calyx being imbricated scales with hooked extremities by which they adhere to objects; achenes oblong, compressed, 3-angled, ribbed; seeds quadrangular; var. *ma'jor* (*ma'jus*), heads large, 2.5 Cm. (1') broad, smoothish involucre; var. *tomento'sum*, involucre and peduncles woolly; var. *mi'nor* (*mi'nus*), heads small, involucre at first cottony, finally smooth, leaves unequally rounded at base. Root, .25–.8 M. (10–30') long, 5–20 Mm. ($\frac{1}{5}$–$\frac{4}{5}'$) thick, nearly simple, fusiform, frequently split, or in broken pieces, grayish-brown, longitudinally wrinkled, crown annulate, sometimes surrounded by a woolly tuft of leaf remains, fracture somewhat horny, dark cambium separating the thick brownish bark from porous radiate wood, centrally hollow or containing white pith-like tissue; odor slight; taste mucilaginous, sweetish, slightly bitter; solvents: diluted alcohol, boiling water partially; contains inulin, bitter extractive, resin, fat 9 p. c., mucilage, sugar, wax, tannin (phlobaphene), lappin, ash 3–4 p. c. Diaphoretic, diuretic, alterative, aperient, depurative; rheumatism, gout, pulmonary catarrh, psoriasis, acne, syphilis, scrofula, urinary deposits; burns, wounds, eruptions, swellings. Dose, ʒss–2

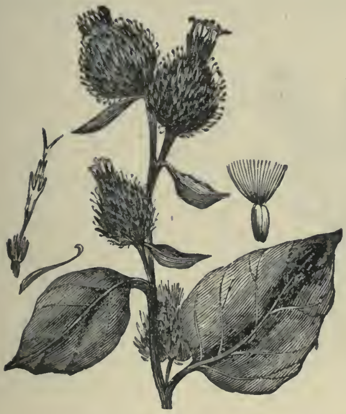


FIG. 431.—*Arctium Lappa.*

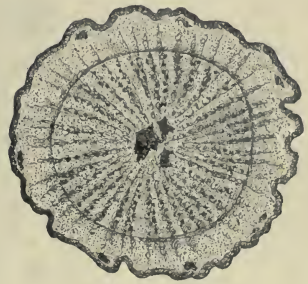


FIG. 432.—Lappa: transverse section, magnified 2 diam.

(2–8 Gm.); fluidextract, ʒss–2 (2–8 Ml. (Cc.)); tincture, 10 p. c. (diluted alcohol, whisky), ʒij–3 (8–12 Ml. (Cc.)), after meals. *Fructus Lappæ, Semen Bardanæ;* seed, official 1830–1840; about 6 Mm. (¼′) long, obovate-oblong, slightly curved, angular, flattened, roughish, brown-gray, mottled with black; inodorous; taste oily, bitter; contains drying oil 15.4 p. c., resins 5.5 p. c., lappin; tincture 25 p. c. (alcohol 75 p. c.), dose, ʒss–2 (2–8 Ml. (Cc.)); fluidextract, ♏xv–30 (1–2 Ml. (Cc.), tonic); ʒss–1 (2–4 Ml. (Cc.), alterative). *Fructus Silybi (Sil′ybum Maria′num), Mary Thistle;* S. Europe; achenes 5 Mm. (⅕′) long, not curved, obovate, flattened, smooth, glossy, light brown, with blackish striæ, brownish; taste oily, bitter. *Bi′dens bipinna′ta, Spanish Needles, Beggar-lice;* stem square, achenes triangular, barbed; stimulant, aromatic (vol. oil), antispasmodic, expectorant, diaphoretic; hay fever, amenorrhœa (hot infusion), asthma, bronchitis. *Rudbeck′ia hir′ta, Yellow Daisy, Black-eyed Susan, Nigger-head;* stimulating diuretic (Eclectic's).

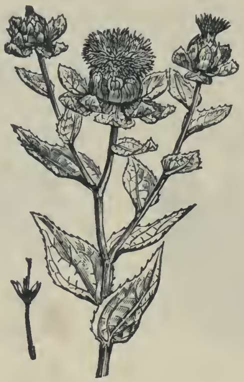


FIG. 433.—*Carthamus tinctorius.*

4. *Xan′thium Struma′rium, Broad Cocklebur.*—Ambrosiaceæ, N. America; achenes 2.5 Cm. (1′) long, flat, oblong, without pappus, enclosed in the involucre, which is densely beset with hooked prickles. *X. spino′sum, Spiny* or *Thorny Clotbur;* N. America, S. Europe; leaves with spines at base 2.5 Cm. (1′) long; fertile axillary burs (achenes) crowned with 1 inconspicuous beak. *X. canaden′se,* and its var. *echina′tum;* achenes with 2 stout beaks, hooked, 2.5 Cm. (1′) long, densely prickly, hispid; river banks, waste places; var. *echinatum,* smaller plant—possibly unworthy of variety distinction.

5. *Car′thamus tincto′rius, Safflower.*—The dried florets, official 1820–1880, India, cultivated; in America, etc. Annual herb .3–.6 M. (1–2°) high, branched; leaves spinose; flowers orange-red, corolla tubular, 2.5 Cm. (1′) long, 5-lobed, odor slight, taste bitter; contain volatile oil, carthamin (red) .5 p. c., saffron yellow 24–30 p. c. Diaphoretic (hot infusion), tonic, laxative; measles, scarlatina (to promote eruption), catarrh, rheumatism; in infusion. Dose, gr. 5–15 (.3–1 Gm.).

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
Solanaceæ:								
1. Capsicum. 2. Capsicum.	Capsicum frutescens.	The dried fruits.	S. and C. America.	Capsaicin, fixed oil, volatile oil, resin, capsicine.	Oleoresin, plaster, tincture.	Stimulant, stomachic, diaphoretic, rubefacient.	Dyspepsia, colic, cholera, diphtheria, menorrhagia, rheumatism, relaxed uvula.	Grains. 1–8 (.06–.5 Gm.).
1. Belladonnæ Folia. 2. Belladonna Leaves.	Atropa Belladonna.	The dried leaves and tops.	C. and S. Europe.	Atropine, belladonnine, hyoscyamine, scopolamine, atropamine, atrosin, malic acid, starch; homatropine.	Extr. (pil., pow.), plaster, ointment, tinct.	Sedative, narcotic, mydriatic, antispasmodic, anodyne.	Rheumatism, neuralgia, sciatica, cancer, meningitis, erysipelas, asthma, coughs, spasms, scarlet fever, abscesses, eczema, phthisis.	½–3 (.03–.2 Gm.).
1. Belladonnæ Radix. 2. Belladonna Root.	....	The dried root.	....	....	Fluidextr., liniment, atropine, atrop. sulph.	....	....	½–2 (.03–.13 Gm.).
1. Hyoscyamus. 2. Hyoscyamus.	Hyoscyamus niger.	The dried leaves and flowering tops.	Europe, Asia.	Hyoscyamine, scopolamine (hyoscine), choline, hyoscipicrin.	Extr., fluidextr., tincture, hyoscyamine hydrobrom., scopolamine hydrobrom.	Anodyne, hypnotic, narcotic, mydriatic, laxative, carminative.	Mania, insomnia, insanity, coughs, colic, paralytic tremors, bladder trouble, constipation, chorea, tetanus.	2–10 (.13–.6 Gm.).
1. Stramonium. 2. Stramonium.	Datura: Stramonium, Tatula.	The dried leaves.	Asia, nat. universally.	Daturine, vol. oil, mucilage, albumin, KNO_3.	Extr. (pil., pow.), ointment, tincture.	Narcotic, anodyne, antispasmodic, diuretic, mydriatic.	Insanity, epilepsy, asthma, whooping-cough, rheumat., dysmenorr., chorea, sprains, ulcers, hemorrhoids.	1–5 (.06–.3 Gm.).
Scrophulariaceæ:								
1. Digitalis. 2. Digitalis.	Digitalis purpurea.	The dried leaves.	W. and C. Europe.	Digitoxin, digitophyllin, gitalin, gitin, digitsaponin, enzymes: vol. oil, digitalin.	Fluidextr., infusion, tinct.	Cardiac tonic, vascular stimulant, sedative, narcotic, diuretic, emetic.	Feeble heart, renal dropsy, pneumon., mania, delirium, menorrhag., epilep., enlarged glands.	1–2 (.06–.13 Gm.).
Pedaliaceæ:								
1. Oleum Sesami. 2. Sesame Oil.	Sesamum indicum.	The fixed oil.	India, Africa, China.	Triglycerides of oleic, linoleic acids, myristin, pal., stea., sesamin.	....	Laxative, demul., emol., nutritious.	Like olive oil; mostly externally in hair preps.	Minims. 240–960 (15–60 Ml. (Cc.)).
Rubiaceæ:								
1. Caffea. 2. Coffee.	Coffea arabica.	Caffeine, feeble basic substance (alkaloid).	Trop. Africa.	$C_8H_{10}N_4O_2 + H_2O$.	Citrat. caffeine, effervesc. citrat. caffeine, caf. sod. benz.	Tonic, stimulant, nervine, antiemetic, diuretic.	Nervous headache, diarrhœa, phthisis, dropsy, gout, insomnia, fevers.	Grains. Caffeine 1–5 (.06–.3 Gm.).
1. Thea. 2. Tea.	Thea sinensis.		S. E. Asia.					
1. Ipecacuanha. 2. Ipecac.	Cephaëlis: Ipecacuanha, acuminata.	The dried root.	Brazil, Bolivia, Columbia.	Emetine, cephaëline, psychotrine, ipecacuanhic acid, resin.	Fluidextr., syr., pulv. ip. et opii.	Emetic, expectorant, diaphoretic, cholagogue, hæmostatic.	Catarrh, croup, asthma, pneumon., dyspep., vomit. of preg., cholera, ophthalmia.	1–20 (.06–1.3 Gm.).
1. Cinchona. 2. Cinchona.	Cinchona: Ledgeriana, Calisaya.	The bark.	S. America, (Java, India, Ceylon).	Quinine, quinidine, cinchonine, cinchonidine, quinamine, chinoidine, quinic, quinovic, cinchotan. acids, cinchona-red, vol. oil.	Fluidextr., tinct. Tinct. cinch. co., alkaloids from either.	Tonic, antiperiodic, antispasmodic, febrifuge, astringent.	Dyspepsia, convalescence, gastritis, asthma, bronchitis, intermitts., typhoid pneumon., neuralgia, erysipelas.	15–60 (1–4 Gm.)
1. Cinchona Rubra. 2. Red Cinchona.	Cinchona succirubra.							
1. Gambir. 2. Gambir.	Ourouparia Gambir.	Dried extr. of leaves, twigs.	E. India Islands.	Tannic acid, catechin.	Tinct. co.	Astringent, tonic.	Diarrhœa, leucorrh., phthisis, bronchitis, relaxed uvula, dyeing.	5–30 (.3–2 Gm.).

RECAPITULATION No. 7—*Continued.*

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
Caprifoliaceæ: 1. Viburnum Prunifolium. 2. Viburnum Prunifolium.	Viburnum: prunifolium, Lentago.	The dried bark.	United States.	Viburnin, valeric acid, tannin, resin.	Extr., fluidextr.	Diuretic, tonic, antispasmodic, nervine, astring.	Dysmenorrh., menorrh., hysteria, asthma.	30–120 (2–8 Gm.).
Valerianaceæ: 1. Valeriana. 2. Valerian.	Valeriana officinalis.	The dried rhizome and roots.	Europe, N. Asia.	Vol. oil, valeric, formic acetic, malic acids, chatinine, tannin, resin.	Tincture, ammoniated tincture.	Stimulant, anodyne, nervine, antispasmodic, vermifuge.	Hysteria, nervous coughs, diabetes, delirium tre., typhoid, dysmenorrh., epilepsy.	15–60 (1–4 Gm.).
Cucurbitaceæ: 1. Pepo. 2. Pepo.	Curcurbita Pepo.	The dried ripe seeds.	Tropic. Asia, America.	Fixed oil, acrid resin, starch, proteids.	....	Tæniafuge, vermifuge.	Tape- and lumbricoid worms.	480–960 (30–60 Gm.).
1. Colocynthis. 2. Colocynth.	Citrullus Colocynthis.	Dried pulp of fruit.	Asia, Africa, S. Europe.	Colocynthin, colocynthitin, pectin, gum.	Extr., comp. extr., pil. cathar. co.	Cathartic, drastic, diuretic, emetic.	Evacuant, dropsy, apoplexy, paralysis.	2–10 (.13–.6 Gm.).
1. Elaterinum. 2. Elaterin.	Ecballium Elaterium.	Neutral principle from elaterium.	W. Asia, N. Africa, S. Europe.	$C_{20}H_{28}O_5$.	Triturate.	Hydragogue cathartic.	Dropsy, brain and lung congestion, uræmia.	$\frac{1}{20}$–$\frac{1}{10}$ (.003–.006 Gm.).
Campanulaceæ: 1. Lobelia. 2. Lobelia.	Lobelia inflata.	The dried leaves and tops.	N. America.	Lobeline, inflatin, lobelacrin, lobelic acid, resin, vol. oil.	Fluidextract, tincture.	Expectorant, emetic, nervine, purg., narcotic.	Spasmod. asth., catarrh, bronch. spasms, whooping-cough.	1–20 (.06–1.3 Gm.).
Cichoriaceæ: 1. Taraxacum. 2. Taraxacum.	Taraxacum officinale.	The dried rhizome and roots.	Europe.	Inulin, pectin, milk-juice, taraxacin, resin, taraxacerin.	Extract, fluidextract.	Diuretic, tonic, aperient, deobstruent.	Liver affections, dyspepsia, constipation, eczema, dropsies.	30–120 (2–8 Gm.).
1. Lactucarium. 2. Lactucarium.	Lactuca virosa.	The dried milk-juice.	C. and S. Europe.	Lactucin lactucic acid, lactucopicrin, lactucerin, vol. oil, caoutchouc.	Tincture, syrup.	Anodyne, sedative, hypnotic, expect., diuretic.	Insomnia, cough, dropsy, heart trouble, nervousness, intermitts.	1–8–15 (.06–.5–1 (Gm.).
Compositæ: 1. Grindelia. 2. Grindelia.	Grindelia: camporum, cuneifolia, squarrosa.	The dried leaves, flowering tops.	N. America.	Vol. oil, resin, bitter principle, grindeline, fat.	Fluidextract.	Cardiac sed., tonic, antispasmod., expect.	Asthma, bronch., catarrhs, whoop.-cough, rheumat., burns, blisters.	15–60 (1–4 Gm.).
1. Matricaria. 2. Matricaria.	Matricaria Chamomilla.	The dried flower-heads.	Europe, W. Asia.	Volatile oil, anthemic acid, anthemidin, tannin.	....	Stimulant, tonic, nervine, carminative, emmenagogue.	Indigest., convales., intermitt., delirium tre., abscesses, colic, toothache, rheumat., sprains.	15–60 (1–4 Gm.).
1. Pyrethrum. 2. Pyrethrum.	Anacyclus Pyrethrum.	The dried root.	N. Africa.	Pyrethrine, resin, vol. oil, inulin, tannin.	Tincture.	Irritant, rubefacient, sialagogue, sternutatory.	Headache, rheumat., toothache, tongue paraly., catarrh, neuralg.	30–60 (2–4 Gm.).
1. Santoninum. 2. Santonin.	Artemisia pauciflora.	The inner anhydride (lactone) of santonic acid.	N. Turkestan.	$C_{15}H_{18}O_3$.	....	Anthelmintic, stimulant, emmenagogue.	Round and thread-worms, incontinence of urine, eye affections.	$\frac{1}{4}$–4 (.016–.26 Gm.).
1. Arnica. 2. Arnica.	Arnica montana.	The dried flower-heads.	Europe, N. Asia.	Arnicin, volatile oil, resin, salts.	Tincture.	Stimulant, tonic, carminative, diuretic, emmenagogue, irritant.	Typhoid, intermitts., diarrhœa, gout, nephritis, amenorrh., rheumat., dropsy,	5–20 (.3–1.3 Gm.).

PART II.

ORGANIC DRUGS FROM THE ANIMAL KINGDOM.

The Animal Kingdom is divided into two great subkingdoms, viz.:

I. Invertebra′ta. L. fr. *in*, not, + *vertebratus*, vertebrated—*i. e.*, not vertebrated. These have no vertebra, backbone, or spinal column.

II. Vertebra′ta. L. fr. *vertebratus*, jointed, articulated—*i. e.*, vertebrated. These have a backbone (spinal bone) surrounding, and thus protecting, the spinal cord, often called conjointly spinal column.

Subkingdom I. **INVERTEBRATA.**

Class 1.: **INSECTA.** L. pl. of *insectum.* This class includes those small animals that have 1 pair of antennæ, 3 pairs of mouth organs, and breathe air by means of tracheæ, opening by spiracles along the sides of the body, as hexapods (6-legged) and myriapods (many-legged).

1. HEMIPTERA. Hemipterous Family.

He-mip′te-ra. L. neut. pl. of *hemipterus*, half-winged, fr. Gr. ἡμι, half, + πτερόν, wing—*i. e.*, insects have forewings partly membranous and partly coriaceous, chitinous. This family includes the various kinds of bugs—hexapod insects, having a jointed proboscis, including 4 sharp stylets (mandibles and maxillæ) for piercing and sucking; have no sucking stomach. They feed upon plant-juices or animal blood. The metamorphosis is mostly incomplete; the molt is, as a rule, repeated 4 times, the stage next to the last, preceding the imago, being called pupa. Includes squash-bug, soldier-bug, bed-bug, cicidas, cuckoo, spites, plant lice, scale insects, thrips, lice.

Genus. **1. Coccus.**

COCCUS. COCHINEAL.

Coccus cacti, *Linné.* } The dried female insect enclosing the young larvæ.

Habitat. Mexico, C. America; cultivated in W. Indies, Canaries, Algiers, S. Spain.
Syn. Cochineal Insect; Fr. Cochenille; Ger. Coccionella, Scharlachwurm.

Coc′cus. L. fr. Gr. κόκκος, a grain, berry, kernel—*i. e.*, from the insect resemblance.

Cac′ti. L. gen. of *cactus*, fr. Gr. κάκτος, a prickly plant—*i. e.*, insects feed upon Cactus species.

Coch′i-ne-al. L. fr. *cochinilla*, L. *coccineus*, scarlet, *coccum*, a berry—*i. e.*, which the kermes insect resembles, and was once supposed to be.

INSECT.—The female when full-grown is 8 Mm. ($\frac{1}{3}'$) long, 6 Mm. ($\frac{1}{4}'$) high, when dry 3.5–5 Mm. ($\frac{1}{7}$–$\frac{1}{5}'$) long, somewhat ovate, convex above, concave beneath, consisting of 9–12 segments, grayish-purple, grayish; numerous larvæ, less than 1 Mm. ($\frac{1}{25}'$) broad, in the shell-like, horny abdomen; mature larvæ with antennæ consisting of 8 joints, 3 pairs of legs, the lower having 6–8 segments and a characteristic beak (rostrum) of 4 thread-like parts which pair off into 2 coils; easily pulverizable into dark red powder; odor characteristic; taste slightly bitter; masticated—colors saliva red; macerated in water—no insoluble powder separates. Dose, gr. 1–15 (.06–1 Gm.).

ADULTERATIONS.—I. SILVER-GRAIN: Barium and lead carbonates or sulphates, talcum, etc. II. BLACK-GRAIN: Graphite, ivory black, manganese dioxide. III. FACTITIOUS: Artificial product made of starch, gum, mineral and coloring matters; also prepared by coloring exhausted cochineal powder with rosaniline, and granulating; recognized by readily forming paste with water. *Tests:* 1. Macerate in water, when the powder separates, the minerals depositing; or burn insects and note the increased ash yield—12–35 p. c. 2. Cold decoction is decolorized by potassium permanganate, preferably in the presence of a little indigo carmine.

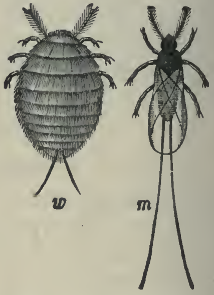


FIG. 435.—Cochineal insects, magnified 3 diam.: *w*, female; *m*, male.

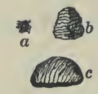


FIG. 434.—*Coccus cacti*, female insect, natural size: *a*, before, and *b*, *c*, after impregnation, dry, and soaked in water.

Commercial.—Female is official, being twice the size of the male, with a rostrum and bluish-red body, underside flat, upper convex, but without wings and bristles, both of which the male possesses. They feed upon Cactus species, especially *Nopa'lea cochenil'lifer* (*Opun'tia coccinellif'era*), to which the females attach themselves and remain continuously at one point, copulating and growing rapidly, until the several thousand eggs are hatched by the sun within the body after death—the body being concealed by a white wax, in the form of a fluffy cotton-like mass. In Mexico, during the rainy seasons, insects are kept on cactus branches under roof, and in good weather are *sown* upon plants without, the young ones being allowed to develop until females become fecundated and enlarged, when they are brushed from the branches into hot water and killed, thereby removing the wax and requiring further drying by sun or fire, producing *black-grain cochineal;* if they are killed by exposure to sulphur fumes and dried by sun or ovens the wax is retained, producing *silver-grain cochineal.* The wild-grown (*granilla,* "little grain," *grana sylvestra,* "wild grain") and the older insects are inferior in the yield of coloring matter. In cultivation some females always are left for propagation (100–200 to each male), which usually produce 3 crops before the return of the rainy season. Aqueous infusion or decoction violet-crimson, brightened by acids, deepened (purplish) by alkalies; upon adding zinc, bismuth, or nickle salts—lilac precipitate; iron salts—dark purple, black; tin salts (nitrate, chloride)—brilliant scarlet; alumina—pigment called *lake;* acids, animal gelatin, (salts of tin), alum, cream of tartar, salt of sorrel —pigment called *carmine*, which contains coloring matter (carminic acid) 50–60 p. c., but often is adulterated with vermilion, lead dichromate, and starch, sometimes to the extent of 60–70 p. c. *Test:* 1. Pure carmine should be entirely soluble in ammonia water, and yield ash 9 p. c.

Constituents.—Carminic acid, $C_{17}H_{18}O_{10}$, 10 p. c., Coccerin (wax), $C_{30}H_{60}(C_{31}H_{61}O_3)_2$, 1–2 p. c., fixed oil (oleic, linoleic, myristic acids), 4–6 p. c., myristin 1.5–2 p. c., fats, gum, volatile oil, ash 3–6 p. c.

Carminic Acid.—This is the coloring matter, being obtained by macerating in ether, treating residue successively with boiling alcohol, from which it deposits upon cooling and spontaneous evaporation; it is brownish-purple, yielding red powder, soluble in water, alcohol, alkalies—which change color of solutions to purple, acids to reddish-yellow, slightly soluble in ether, insoluble in fixed and volatile oils. When boiled with diluted sulphuric acid splits into sugar and carmine-red, $C_{11}H_{12}O_7$, a vermilion-red powder, soluble in water, alcohol, and alkalies.

Preparations.—1. *Tinctura Cardamomi Composita,* ½ p. c.

Unoff. Preps.: Infusion (*Infusum Cocci*), dose, ℥ss–1 (15–30 Ml. (Cc.)). *Tinctura Cocci* (Br.), 10 p. c. (alcohol 45 p. c.), dose, ♏v–30 (.3–2 Ml. (Cc.)). *Liquor Cocci,* 6.5 p. c., + potassium carbonate 3.2, alum 3.2, potassium bitartrate 6.5, glycerin 50, alcohol 3.2, water q. s. 100. *Liquor Carmini,* carmine 6.5 Gm., + ammonia water 36.5, glycerin 36.5, water q. s. 100.

Properties.—Stimulant, antispasmodic, diuretic.

Uses.—Whooping-cough, neuralgia, chiefly for its coloring properties, especially carmine; in tinctures; tooth powders, etc.

Allied Insects:

1. *Coccus ili'cis.*—Greece (Morea, mountains); inhabits *Quercus cocci'era;* consists of females, size of a pea, brownish-red; used natively as a dye, and called *kermes, chermes,* or *alkermes;* with tin salts gives scarlet-red precipitate like the official.

2. *Spon'gia officina'lis, Sponge.*—Ceratospongiæ. The fibrous framework, official 1820–1850. In seas, attached to rocks, sometimes planted. Animal, the lowest order living in water, composed of amœbiform bodies disposed about a common cavity, with one or more breathing orifices through which water flows in and out. We use the fibrous framework from which the animalcules (gelatinous matter or flesh), gritty and sandy parts have been washed. Sponges are torn from rocks by hands or forks, buried in sand several days to disintegrate animal matter, soaked in water, squeezed, and washed. There are several

varieties: 1, Mediterranean, Turkey; 2, Zimocca (coast of Greece); 3, Bathing (N. Africa); 4, Sheep's Wool (Bahama, Florida, Nassau). These are yellowish-brown, but may be bleached by sulphur dioxide, chlorine, sulphurous acid solution, or by dipping them into a 2–3 p. c. solution of potassium permanganate, and washing in a 2–3 p. c. solution of oxalic acid. Sponge contains spongin, also NaCl, $CaCO_3$, Mg, Si, Fe, S, P, Br, I, K, ash 3–4 p. c. Used mechanically for cleansing, washing, absorbing liquids, dilating cavities (sponge tents), supporting parts (pessaries) in dysmenorrhœa, to cause premature labor. When compressed usually coated with wax to prevent absorbing moisture, hence expansion. *Spongia Usta, Burnt Sponge;* official 1820–1860. Heat sponge in a coffee-roaster until weight is one-fourth less; the residue is mostly charcoal, while 30–35 p. c., the part used, consists of calcium sulphate 25–30 p. c., silica 10 p. c., ferrous oxide 9 p. c., also magnesium carbonate, potassium chloride, calcium phosphate, and sodium iodide .5–1 p. c. Now superseded by iodine.

3. *Sanguisu'ga (Hirudo) medicina'lis*, and *S. officina'lis (quinquestria'ta)*, *Hirudo, Leeches* (Br.).—Annulata. 1, C. and N. Europe (Swedish, German Leech); 2, S. Europe (Hungarian Leech); in fresh-water ponds. These animals are 7.5–15 Cm. (3–6′) long, smooth, soft, round, flattened, composed of 90–100 rings, disk at each end, in the centre is the mouth, containing 3 jaws, having many teeth; back olive-green with 6 reddish stripes dotted with black, belly greenish, sides black-spotted or with a black line. The first withdraws a quantity of blood equal to its weight, the second more, while a still larger quantity flows after leech falls off. They disgorge the blood when placed in a solution of salt, although such should not be used again within 6 months. Used for local depletion.

Calcareous Related Products:

1. *Os'trea virginia'na* and *O. ed'ulis, Testa, Oyster-shell.*—Monomya. The inner white layer of the shell, official 1830–1880. Atlantic and Indian Ocean coasts. Animal has soft, fleshy, suborbicular body, enclosed in a calcareous shell opening by a hinge at one end into 2 valves (bivalved), the deeper one adhering to a rock, etc. Shell is rough, gray outside; inside white, glossy, smooth. For medicine (testa præparata) they are boiled, outside layer removed and inside one powdered, separating coarse particles by elutriation; contains calcium carbonate 88–98 p. c., calcium phosphate and sulphate, also Mg, Al, Si, Fe_2O_3. Used as antacid for diarrhœa, chronic bowel affections. Dose, gr. 5–30 (.3–2 Gm.).

2. *Oculi'na virgin'ea* and *Coral'lium ru'brum, Corallium, Coral.*—Hexa (Octo)-coralla; Mediterranean Sea, Atlantic Ocean. Polypipherous animals having a skeleton and a fleshy portion. The calcareous skeleton is branched like a shrub, and on these branches are the individual animals in tube-like apertures; skeleton is used in medicine; occurs in hard, cylindrical, branching pieces, porous, striate surface, radiating interior, often hollow, inodorous, tasteless, white (first) or red (second); contains animal matter 8 p. c., $CaCO_3$ 83 p. c., $MgCO_3$

3.5 p. c., Fe_2O_3 (red coral) 4.25 p. c. Used in tooth powders and as an antacid. Dose, gr. 5–30 (.3–2 Gm.).

3. *Se'pia officina'lis, Os Sepiæ, Cuttle-fish Bone.*—Decapoda; Mediterranean, Atlantic Ocean. A calcareous substance under the skin of the back of the cuttle-fish, often found floating in the water; occurs 12.5–25 Cm. (5–10′) long, 2.5–7.5 Cm. (1–3′) wide, outside hard, smooth; inside porous, friable, inodorous, taste saline; contains $CaCO_3$ 80–85 p. c., NaCl, MgO, $Ca_3(PO_4)_2$. Used as an antacid like chalk, oyster-shell, etc., also in tooth and polishing powders, chiefly now for caged birds to rub (sharpen) their bills against.

4. *As'tacus fluvia'tilis, Crawfish.*—Decapoda; Russia. The stomach of this contains concretions known as *calculi* (*lapides*) *cancrorum*, *crabs' eyes* or *stones*, which are obtained by washing putrefied animals. These are circular, 3–10 Mm. ($\frac{1}{8}$–$\frac{2}{5}$′) broad, plano-convex, white, hard, inodorous, tasteless; contain animal matter 12–15 p. c., calcium carbonate 63 p. c., calcium phosphate 17 p. c. Used as an antacid. Dose, gr. 5–30 (.3–2 Gm.).

2. COLEOPTERA. Coleopterous Family.

Ko-le-op'te-ra. L. pl. of *coleopterum*, fr. Gr. *κολεός*, a sheath, + *πτερόν*, a wing—*κολεόπτερος*, sheath-winged—*i. e.*, insects having the posterior pair of wings membranous and sheathed by the hardened anterior pair, called *elytra*, which, when folded together, usually form a nearly complete covering of the body. This family includes the beetles and weevils, all of which not only have their 2 pairs of wings arranged as above described, but their mouth parts, forming 2 pairs of jaws (mandibles and maxillæ), adapted for chewing. The larva is variable, having 6 legs or none, no prolegs, pupa inactive; metamorphosis is complete.

Genus: **1. Cantharis.**

CANTHARIS. CANTHARIDES.

Cantharis vesicatoria, *(Linné) De Geer.*	The dried beetles, containing .6 p. c. of cantharidin.

Habitat. S. and C. Europe, W. Asia—Spain, Italy, Sicily, S. France, Hungary, S. Russia.

Syn. Canthar., Spanish Flies (Fly), Russian Flies, Blister Beetle, Muscæ Hispanicæ, Lytta vesicatoria; Fr. Cantharide; Ger. Cantharides, Spanische Fliegen, Canthariden, Kanthariden.

Can'tha-ris. L. pl. *cantharides*, a beetle, fr. Gr. *κανθαρίς*, a beetle, Spanish fly—*i. e.*, the classic name.

Ves-i-ca-to'ri-a. L. *vesica*, a blister, of or belonging to or capable of blistering.

Insect.—About 15–25 Mm. ($\frac{3}{5}$–1′) long, 5–8 Mm. ($\frac{1}{5}$–$\frac{1}{3}$′) broad, oblong, compressed above, brilliant green, bluish-green, metallic lustre, golden-green beneath; head triangular, mandibles stout, antennæ filiform, of 11 conical joints, the upper black; eyes small, prothorax angular; legs with 5 tarsal joints; wings membranous, brownish, elytra (wing sheaths) with 2 parallel lines, finely wrinkled; odor strong, disagreeable; taste slight, acrid. POWDER, grayish-brown; microscopically—shining green particles, many long, pointed, 1-celled hairs, .5 Mm. ($\frac{1}{50}'$) long, .02 Mm. ($\frac{1}{1250}'$) broad; must not be used when having ammoniacal odor. Should be kept in tightly-closed containers adding occasionally a few drops of chloroform or carbon tetrachloride to prevent insect attack. *Solvents:* alcohol; chloroform. Dose, gr. $\frac{1}{6}$–1 (.01–.06 Gm.).

ADULTERATIONS.—BEETLE: Other beetles easily recognizable, exhausted flies, beads, etc.; POWDER: Ground euphorbium (gumresin), etc.; all detected by diminished yield of cantharidin and increased amount of ash, which should not exceed 8 p. c.

Commercial.—Females lay eggs in cylindrical holes in the ground, June, the larvæ hatching a week later and depending upon flowers and the resources of the bee for a month, when they burrow in the ground to assume the chrysalis stage and to hatch as perfect beetles next spring. They swarm, May, June, upon trees and shrubs—ash, white poplar, privet, lilac, elder, honeysuckle (Oleaceæ, Caprifoliaceæ), feeding on the leaves, and, having a penetrating odor resembling that of mice, can easily be recognized at a distance. In the early morning, at sunrise, when insects are torpid from the coldness of night and release readily their attachment, persons masked and gloved shake and beat the trees with poles, collecting them in cloths previously spread underneath; they then are plunged into hot water or diluted vinegar, or exposed to vapors of either vinegar, chloroform, ether, oil of turpentine, ammonia, or carbon disulphide, and thus killed are spread out, dried by sun or ovens, and packed in boxes or casks for market. Russian flies supply the trade, entering commerce via Moscow, Hamburg, Petrograd (St. Petersburg), in barrels (best in paper-lined boxes), being copper-color, larger and more esteemed than those of S. Europe. All blistering beetles should be kept dry, in air-tight vessels, with a little camphor, chloroform, ether, oil of turpentine, benzene, or carbon disulphide, which protects against the ravages of mite larvæ, etc.

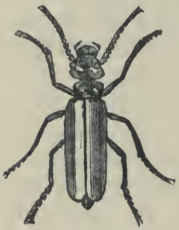


FIG. 436.—*Cantharis vesicatoria.*

CONSTITUENTS.—Cantharidin, $C_{10}H_{12}O_4$, .4–1 p. c., fat, inert oil (soluble in alcohol), yellow viscid matter (soluble in water and alcohol), volatile principle (giving the odor), yellow substance (soluble in ether, alcohol), black extractive, chlorophyll, phosphates of calcium, magnesium, formic, acetic and uric acids, moisture 10 p. c., ash 6–9 p. c.

Cantharidin.—Obtained by exhausting with chloroform, evaporating spontaneously; crystals have fat and coloring matter adhering, which are removed by carbon disulphide. Occurs in colorless, odorless, tasteless prisms, soluble in hot alcohol, ether, chloroform, fats, volatile oils, glacial acetic acid, sparingly in water, cold alcohol, sublimable, with alkalies yields cantharidates; cantharidin is the blistering principle and resides mostly in soft parts.

Valuation.—Exhaust with chloroform containing some hydrochloric acid or acetic ether, evaporate, deprive of fat and color by carbon disulphide; should yield cantharidin .4–1 p. c.

Preparations.—1. *Ceratum Cantharidis.* Cantharides Cerate. (Syn., Cerat. Canthar., Blistering Cerate (Plaster), Br. Emplastrum Cantharidini; Fr. Emplâtre de Cantharides Mitigu'; Emplastrum Vesicans; Ger. Emplastrum Cantharidum ordinarium (vesicatorium), Spanischfliegenpflaster, Blasenpflaster.)

Manufacture: 35 p. c. Macerate in a well-covered container, in a warm place, cantharides 35 Gm., oil of turpentine 15 Ml. (Cc.) and glacial acetic acid 2.5 Ml. (Cc.), previously mixed, then add this to yellow wax 17.5 Gm., rosin 17.5 Gm., benzoinated lard 20 Gm., previously melted and strained; keep in liquid condition over water-bath, stirring occasionally, until reduced in weight to 100 Gm., withdraw heat, stir until firm.

Prep.: 1. *Emplastrum Cantharidis.* Cantharides Plaster. (Syn., Emp. Canthar., Cantharidal Pitch Plaster; Br. Emplastrum Calefaciens, Warming Plaster; Fr. Emplâtre de Poix Cantharide; Ger. Pechpflaster mit Canthariden.)

Manufacture: Spread cantharides cerate upon rosin plaster previously spread on fabric—muslin, paper, etc., leaving a margin around the edges; each □ Cm. contains .1 Gm. of cantharides cerate; Br. contains cantharidin $\frac{1}{50}$ p. c.

2. *Tinctura Cantharidis.* Tincture of Cantharides. (Syn., Tr. Canthar., Tincture of Spanish Flies; Fr. Teinture de Cantharides; Ger. Tinctura Cantharidum, Spanischfliegentinktur.)

Manufacture: 10 p. c. Agitate thoroughly 10 Gm. with alcohol 100 Ml. (Cc.) in a strong tin can having a tightly fitting cork with small glass tube, keep on water-bath at 50–55° C. (122–131° F.) for 24 hours, frequently shaking, transfer to a percolator having in the neck a pledget of purified cotton, percolate, finishing with alcohol q. s. 100 Ml. (Cc.). Dose, ♏j–20 (.06–1.3 Ml. (Cc.)).

3. *Collodium Cantharidatum,* 60 p. c.

Unoff. Preps.: Liquor Epispasticus (Br.), cantharidin $\frac{2}{5}$ p. c. *Unguentum Cantharidini* (Br.), cantharidin $\frac{1}{33}$ p. c.

Properties.—Diuretic, aphrodisiac, emmenagogue, rubefacient, vesicant, acrid poison. Blisters (blebs) are for stimulation, but may produce consitutional symptoms, and if allowed to remain on long depress according to amount of serum discharged, which contains equal quantities of albumin and blood. Absorbed rapidly into the blood and eliminated by the kidneys with marked irritation. Locally causes in 2–3 hours tingling, burning pain, vascular dilatation, and reflexly dilates deep-seated bloodvessels.

Uses.—Hectic fever, dropsy, bronchitis, skin diseases, bladder weakness, gleet, vesical catarrh, diabetes, amenorrhœa, seminal emissions, gonorrhœa, menorrhagia; externally—blisters stimulate the whole or part of the system, prevent accumulation of inflammatory exudations, recall suppressed discharges, are depletory, and thus relieve internal congestions. Applied for ulcers, fistulæ, psoriasis, lupus, erysipelas, boils, alopecia, brain congestion and dropsy, hemorrhage, hydrocele, pleurisy, gleet (under the penis), leucorrhœa (sacrum), dysmenorrhœa, buboes, abscesses, typhus, typhoid fever, apoplectic condition, inflamed eyes (back of ears), pneumonia, pericarditis, phlebitis, bowel fluxes, rheumatism, neuralgia, spinal irritation, convulsions, tetanus, meningitis, wasting away of muscles, vomiting. Blisters should remain on 4–8 hours, or until skin vesicated, which is aided by previously washing the affected part with soap and applying vinegar. If the spot is to be healed at once, cut off cuticle, absorb serum, which is clear, apply pledget of borated cotton and bandage; if the sore is to be prolonged, remove cuticle, apply simple cerate for one day, then basilicon ointment until discharge is purulent, after which continue as long as desired with savin or mezereum ointments. In young persons intractable sores are produced easily by blisters, and in old persons gangrene, hence they should be applied to both with moderation; when such conditions have been produced Goulard's cerate is valuable. Strangury may be avoided by sprinkling plaster with spirit or powdered camphor, sodium bicarbonate, or even powdered cantharides. The tincture is the internal preparation, and the one used in hair lotions.

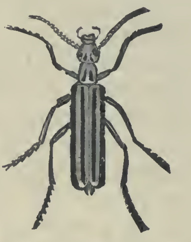


Fig. 437.—*Cantharis vittata.*

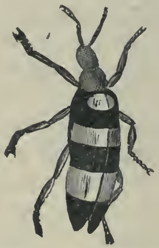


Fig. 438.—*Mylabris cichorii.*

Poisoning: Have violent gastro-enteritis, abdominal tenderness, burning in pharynx and œsophagus, burning pain in back, bladder, and urethra, constriction of throat, great desire to urinate, but urine scanty, mixed with blood and albumin, and passed with pain, vomiting, bloody stools, depression preceded by increased heart force and rapidity, strangury, swollen genitals, increased sexual desire, abortion, convulsions, coma, death. Give vegetable emetics, mucilaginous drinks freely —barley water, flaxseed tea, but not oils or oily emulsions, as these favor solubility and absorption of cantharidin; stimulants (brandy, ammonia, strychnine, atropine), warm baths, and cataplasms to abdomen, opium by mouth, and enema (for pain and gastro-enteritis).

Allied Insects:

1. *Cantharis vitta'ta, Potato Fly;* official 1820–1860; United States. Smaller than *C. vesicatoria*, but the two resemble; thorax and wing-cases black, the latter with yellow margin and middle stripe, making 3 yellow bands, head light red with dark spots on top, abdomen and

legs covered with cinereous down 12 Mm. (½′) long. This beetle inhabits Irish (white) potato vines, July–Aug., morning and evening, hiding in the soil during hot hours of the day. Collect by shaking into boiling water; contains cantharidin 1.3 p. c. Used as vesicant like the official. *C. cine′rea* (American; black, closely punctured, covered with ash-gray hairs); *C. margina′ta* (elytra black, margin ash-colored), *C. atra′ta* (black, 8 Mm. (⅓′) long), and *C. Nuttal′li*, (Kansas, California; resembles official); wing-cases golden-purple striped with green.

2. *Myl′abris cicho′rii,* and *M. phalera′ta, Chinese Blistering Flies.*—S. and E. Asia. Black wing-cases with 2 orange-yellow bands, and at base 2 yellow spots; powder, blackish-gray, with no glossy-green particles; contains 1–1.7 p. c. cantharidin. Our Pharmacopœia recognizes only 2 insects, cantharis and coccus, while a few countries accept some others: 1, *Formi′ca ru′fa, Red Ant.* Used in Germany in spirit and tincture (Tinctura Formicarum—2 parts + alcohol 3) for rheumatism, gout, paralytic affections. Dose, ♏xv–30 (1–2 Ml. (Cc.)); 2, *Blat′ta orienta′lis, Cockroach.* Asia. Blackish, 2.5 Cm. (1′) long, broad, flat, habits nocturnal; odor disagreeable. Oily decoction used for warts, ulcers, boils, scaly eruptions; internally for dyspnœa, dropsy, albuminuria, diuretic. Dose, gr. 4–5 (.3 Gm.), per die; 3, *Æ′nas a′fer.* Spain. Has advantage over cantharides in being cheaper, equally powerful, acting without pain, and non-irritating to the urinary organs.

3. HYMENOPTERA. Hymenopterous Family.

Hi-me-nop′te-ra. L. neut. pl. of *hymenopterus*, fr. Gr. ὑμενόπτερος, membrane-winged; ὑμήν, membrane, + πτερόν, wing—*i. e.*, animals have membranous wings. This family includes the highest insects, because of their superior structural development, instinctive faculties, and social qualities. They have 4 membranous wings, the anterior pair being the larger, with a thickened dark spot on their front side, few reticulations; the tarsi 4–5-jointed; the tongue or lingua is converted into an organ for sucking honey, liquid food, etc., and the mandibles are adapted to biting or cutting. In bees, wasps, and ants the multivalve ovipositor of the female (workers) is modified into a sting.

Genus: **1. Apis.**

APIS MELLIFERA. THE HIVE OR HONEY BEE.

1. Mel. Honey.
2. Cera Flava. Yellow Wax.

Apis mellifera, *Linné.*	1. A saccharine secretion deposited in the honey-comb by the bee. 2. A product obtained by melting and purifying the honey-comb of the bee.

Habitat. N. America, Europe.

Syn. 1. Fr. Miel blanc; Ger. Honig. 2. Cer. Flav., Beeswax, Yellow Wax (Beeswax), Cera Citrina; Fr. Cire jaune; Ger. Cera flava, Gelbes Wachs.

A′pis. L. a bee, Gr. ἐμπίς, a giant—*i. e.*, from its classical name.

Mel-lif′e-ra. L. *mellifer*, honey-producing, fr. *mel, mellis*, honey, + *ferre*, to bear.

ANIMAL.—About 15–20 Mm. ($\frac{3}{5}$–$\frac{4}{5}'$) long, 4–5 Mm. ($\frac{1}{6}$–$\frac{1}{5}'$) broad, grayish-brown, chin (mentum) elongated, tongue short, labium and terminal maxillary lobes lengthened into proboscides, labium hastate or cordate. It has been hived from the earliest times for its honey and wax; lives in swarms of 10,000–50,000 individuals, consisting of 3 kinds or classes—perfect females (queen bees), undeveloped females (neuters, working bees), and males (drones). In each swarm there is only one queen bee, much larger than the others, whose sole function is to propagate (laying about 2,000 eggs daily), and at whose death a young, 3-day-old, working bee is selected, her cell enlarged and food changed to royal jelly or paste, whereby she soon grows into a queen—the inspiration centre; the drones (several hundred) are gentlemen of leisure—an abundant supply from which the queen may be insured a rightful mate for her own impregnation, when those remaining are destroyed by the neuters, these being the numerous laborers that suck honey from flowers with their proboscides, swallow it with their mouths and later disgorge it into the honey-cells as food for the other bees, old and young—the pollen attaching itself to them simply being utilized as bee-bread for the larvæ. Formerly wax was considered a formation from pollen, but now it is accepted as a secretion from honey. The neuters have a barbed sting attached to a sac of poison which flows into the inflicted wound causing severe pain. When the hive becomes overstocked a new colony is sent out under the direction of a queen bee (swarming).

I. MEL, HONEY.—This is a thick, syrupy liquid, yellowish-brown, translucent when fresh, gradually becoming opaque and crystalline; characteristic odor; sweet, faintly acrid taste, slightly acid, lævorotatory. The honey from hives which never have swarmed is virgin honey, the finest being allowed to drain simply from the comb, the impure grades with the aid of pressure. *Tests:* 1. Diluted with twice its weight of water—moderately turbid, non-stringy, sp. gr. 1.099, corresponding to sp. gr. 1.370 for the original honey. 2. Incinerate 1 Gm.—ash .3 p. c. *Impurities:* Starch, dextrins, chlorides, sulphates, azo dyes, foreign coloring matter, artificial or added invert sugar.

CONSTITUENTS.—Grape-sugar or dextrose (becoming crystalline) 32–42 p. c., fruit-sugar or levulose (remaining liquid) 32–42 p. c., wax, volatile oil, proteids, mucilage, coloring matter, formic acid, ash .1–.3 p. c., usually suspended pollen grains.

PREPARATIONS.—1. *Mel Depuratum.* Clarified Honey. (Syn., Mel Depurat., Mel Despumatum; Fr. Miel despume, Mellite simple, Sirop de Miel; Ger. Gereinigter Honig.)

Manufacture: Mix honey with 2 p. c. of shredded, washed, soaked, expressed, and reshredded paper pulp, heat on water-bath at 70° C. (158° F.), carefully removing scum rising to the surface, add distilled water q. s. for loss in evaporation, strain, mix with 5 p. c. of glycerin. Dose, *ad libitum.*

Preps.: 1. *Mel Rosæ.* Honey of Rose. (Syn., Mellitum Rosatum; Fr. Mellite de Roses rouges, Miel Rosat; Ger. Mel rosatum, Rosenhonig.)

Manufacture: 88 p. c. Mix fluidextract of rose 12 Ml. (Cc.) with clarified honey q. s. 100 Gm. Dose, ʒj–2 (4–8 Ml. (Cc.)).

2. *Hydrargyrum Cum Creta,* 10 p. c. 3. *Massa Ferri Carbonatis,* 38 p. c.

Unoff. Prep.: Oxymel (Br.)—purified honey 5, acetic acid 1, distilled water 1; sometimes used in cough mixtures, dose, ʒj–2 (4–8 Ml. (Cc.)).

PROPERTIES AND USES.—Demulcent, laxative; externally stimulant, nutritive, relieves dryness of mouth, facilitates swallowing; in gargles for aphthæ, thrush, pseudomembranous deposits; in poultices for boils, carbuncles, fissures of nipples; in plasters for drying up mammary secretion.

II. CERA FLAVA, YELLOW WAX.—The honeycomb, after draining the honey, is melted in water, impurities allowed to subside, then cooled; a second or third melting produces each time a purer product. It is a yellow, gray-brown solid, agreeable, honey-like odor, faint characteristic taste, somewhat brittle when cold, fracture dull, granular, not crystalline, plastic by heat of hand, soluble in chloroform, ether, fixed or volatile oils, partly in benzene, carbon disulphide, sparingly in alcohol, when boiling dissolving cerotic acid and part of the myricin; insoluble in water; sp. gr. 0.955, melts at 63° C. (146° F.). *Impurities.*—Fats, fatty acids, Japan wax, rosin, soap, paraffin, ceresin—this latter most frequently, 10–45 p. c.

CONSTITUENTS.—Hydrocarbons, $C_{27}H_{56}$ and $C_{34}H_{64}$, 12–14 p. c., cerin or cerotic acid, $C_{27}H_{54}O_2$, crystallizes from boiling alcohol; myricin or myricyl palmitate, $C_{30}H_{61}C_{16}H_{31}O_2$ (principal constituent, acicular crystals, soluble in hot ether), an alcohol, $C_{25}H_{52}O$, ceryl alcohol, $C_{27}H_{56}O$.

PREPARATIONS.—1. *Cera Alba.* White Wax. (Syn., Cer. Alb., White Beeswax; Fr. Cire blanche; Ger. Cera alba, Weisses Wachs.)

Manufacture: Yellow wax, in thin sheets, is bleached by exposure to moisture, air, and sunlight. It is a yellowish-white solid, somewhat translucent in thin layers, faint characteristic odor, nearly tasteless, non-rancid; sp. gr. 0.955, melts at 63° C. (146° F.).

Preps.: 1. *Ceratum,* 30 p. c. 2. *Unguentum,* 20 p. c. 3. *Unguentum Aquæ Rosæ,* 12 p. c.

2. *Emplastrum Elasticum.* Rubber Plaster. (Syn., Emp. Elast., Rubber Adhesive Plaster; Fr. Emplâtre Caoutchouc; Ger. Kautschukpflaster.)

Manufacture: A mixture of rubber, resins and waxes, with a filler of an absorbent (orris root, starch, etc.), mechanically mixed and spread upon fabric—cotton cloth, etc.

3. *Ceratum Cantharidis,* 1.75 p. c. 4. *Ceratum Resinæ,* 15 p. c. 5. *Emplastrum Resinæ,* 6 p. c. 6. *Unguentum Picis Liquidæ,* 15 p. c.

PROPERTIES AND USES.—Mostly as bases for plasters, cerates, ointments; formerly in diarrhœa, dysentery, rheumatism, gleet, neuralgia; locally as a protective from cold and to aid cutaneous transpiration.

SUBKINGDOM II. **VERTEBRATA.**

CLASS 2: **PISCES.** L. pl. of *piscis*, a fish. This class includes the oviparous animals that have fins and a covering of scales or plates. They breathe by gills, live almost entirely in water, swim instead of walking or flying, have a complete cranium, and a lyriform shoulder girdle.

4. TELEOST(EÆ)-IA. Teleostean Family.

Tel-e-os′te-e. L. *teleosteus*, fr. Gr. τέλεος, complete, + οστέον, a bone—*i. e.*, has a well-ossified skeleton, like ordinary fishes. This family has well-developed brain, optic nerves cross each other, but without any chiasm; heart has a non-contractile arterial bulb, fins have well-developed and distinct rays; skeleton is completely ossified, the backbone being composed of well-ossified vertebræ.

Genus: **1. Gadus.**

OLEUM MORRHUÆ. COD LIVER OIL.

Gadus Morrhua, *Linné,* and other species. } A fixed oil from the fresh livers.

Habitat. N. Atlantic Ocean.

Syn. The Cod (fish), Ol. Morrh., Oleum Hepatis Morrhuæ, Cod Oil; Fr. Huile de Foie de Morue, Huile de Morue; Ger. Oleum Jecoris Aselli, Lebertran, Stockfischlebertran.

Ga′dus. L. a codfish, Gr. γάδος, same as όνος, L. *asellus*, a certain kind of fish.
Mor′rhu-a. L. a cod (fish), fr. *morua*, *mortua*, ult. *merula*.

ANIMAL.—The common codfish is .6–1 M. (2–3°) long, with brown or yellowish spots on the back; body somewhat elongated and compressed, with soft small scales, none being on the head; fins soft, 3 on the back, 2 anal, and 1 distinct caudal; teeth irregular, pointed, in several ranks; gills large, 7-rayed.

Oleum Morrhuæ, Cod Liver Oil.—It is a pale yellow, thin, oily liquid, peculiar, slightly fishy, but not rancid odor, fishy taste, soluble in ether, chloroform, carbon disulphide, ethyl acetate, slightly in alcohol, sp. gr. 0.920. *Tests:* 1. Dissolve 1 drop in chloroform 1 Ml. (Cc.), shake with 1 drop of sulphuric acid—violet-red tint, gradually changing to reddish-brown. 2. Allow 2–3 drops of fuming nitric acid to flow alongside of 10–15 drops of oil—reddish, purplish color at zone of contact, changing to bright rose-red on stirring (dist. from seal oil, which shows no change, and other fish oils, which become blue). 3. Slightly acid to litmus paper moistened with alcohol (abs. of free fatty acids). Should be kept cool, in well-closed containers, having been well dried before filling. Dose, ʒj–4 (4–15 Ml. (Cc.)).

ADULTERATIONS.—Allied fish oils (seal, shark, menhaden, haddock, skate, etc.), other fixed oils, rosin (soluble in alcohol), paraffin oil (saponifies with potassium hydroxide in alcoholic solution), free fatty acids, lard oil.

Commercial.—The codfish abounds in the waters off Newfoundland, Norway, Nova Scotia, New England, north of Boston, where several species of *Gadus* are used for the oil: *G. calla'rias* (*Morrhua america'na,* Dorsch), *G. carbona'rius* (Coalfish), *G. polla'chius* (Pollack), *G. merlu'cius* (Hake), *G. æglef'inus* (Haddock). Fishermen in small boats do most of the catching, Dec.–March, and upon reaching shore clean and salt the fish, reserving livers for the oil, which may be rendered in an atmosphere of carbon dioxide to prevent oxidation, or more frequently by simply boiling livers with water or superheated steam to disintegrate tissue and allow the oil to separate to the surface, above the aqueous substratum, when it can be drawn off, strained, and run into butts in the cooling-room, where, after freezing to a solid, it is expressed through canvas bags, and then barrelled or bottled for market as *shore, white, pale yellow oil,* the hard, yellow residue (stearin, liver *débris*) being sold for soap-making. Frequently large boats remain for weeks at sea collecting and salting the fish, for food, throwing offal overboard, and the livers into barrels to become decomposed, thus disintegrating tissue and separating the oil, which, rising to the surface, is racked off and bottled, being, darker and less sweet than the preceding, and known as *straits, brownish-yellow oil.* The remaining putrid *débris* may be heated with steam or water, giving a black oil of offensive odor and taste, and known as *banks, dark brown oil.* The oil-extracting is conducted on shore by individuals in a small way, or by large factories, either near the seat of capture or at remote points supplied with livers in refrigerator cars. Oil of good quality may be obtained by simply boiling livers in water to a pulp, straining through canvas, subsidence, decanting, and filtering.

Constituents.—Chiefly olein (physetolein) 70 p. c., palmitin 25 p. c., little stearin, palmitic acid 4 p. c., jecoleic acid, $C_{19}H_{36}O_2$, 20 p. c., therapic acid, $C_{17}H_{26}O_2$, iodine .001–.002 p. c., 3 alkaloids—trimethylamine, C_3H_9N, aselline, $C_{25}H_{32}N_4$, morrhuine, $C_{19}H_{27}N_3$ (diuretic, diaphoretic), cholesterol .5–1.5 p. c., traces of chlorine, bromine, phosphorus, sulphur .3 p. c., cholesterin, morrhuic acid, $C_9H_{13}NO_3$, probably butyric and acetic acids. With alcohol (90 p. c.) oil yields 3.5–6 p. c. of extract called *morrhuol,* in which active virtues reside.

Preparations.—1. *Emulsum Olei Morrhuæ.* Emulsion of Cod Liver Oil. (Syn., Emuls. Ol. Morrh.; Fr. Emulsion de Huile de Foie de Morue; Ger. Emulsio Olei Jecoris Aselli, Lebertranemulsion.)

Manufacture: Rub acacia 12.5 Gm. with cod liver oil 50 Ml. (Cc.) in dry mortar until mixed, add at once water 25, triturate lightly and rapidly by hand, or suitable mechanical device, until complete emulsification, add methyl salicylate .4, syrup 10, water q. s. 100 Ml. (Cc.); may replace methyl salicylate by any other flavoring ingredient, as oil of bitter almond, etc. Dose, ʒj–4 (4–15 Ml. (Cc.)).

Unoff. Preps.: Emulsion of Cod Liver Oil with Hypophosphites, 50 p. c., + calcium hypophosphite 1, potassium hypophosphite .5, sodium hypophosphite .5, acacia 12.5, oil of betula, or bitter almond, etc. .4, syrup 10, water q. s. 100 Ml. (Cc.), dose, ʒj–4 (4–15 Ml. (Cc.)). *Emulsion with Calcium Lactophosphate,* 50 p. c., + calcium lactophosphate 5, lactic acid 1.6, +. *Emulsion with Calcium Phosphate,* 50 p. c., + precipitated calcium phosphate, 3.5, +. *Emulsion with Malt,* 30 p. c., + extract of malt 50, +. *Emulsion with Wild Cherry,* 50 p. c., + fldext. of wild cherry 6.5, +. *Emulsion with Egg,* 50 p. c., + glycerite of egg yolk, 17.5, +.

PROPERTIES.—Alterative, demulcent, emollient, nutrient. Owing to it already having been prepared by the liver, therefore partly elaborated, it is the most easily digested of the fats; increases red blood-corpuscles, body-weight, and healthy cell-formation throughout the tissues; pancreatic juice resolves it into glycerin and fatty acids, the latter unite with alkalies of the bile and intestinal juice, forming soaps, the larger portion, however, is emulsionized by alkaline secretions of the intestines. It is absorbed readily by the skin, and large doses may occasion diarrhœa.

USES.—Wasting diseases, chronic phthisis, bronchitis, rheumatism, skin diseases, neuralgia, chorea, epilepsy, nerve tonic, convalescence from acute diseases, scrofula, white swelling, chronic arthritis (gout).

To take internally may disguise odor and taste: 1, Emulsion + oil of bitter almond (1 to 250); 2, Porter ʒj (30 Ml. (Cc.)) + oil + plenty froth on top; 3, Orange- or lemon-peel chewed before and after taking; 4, Common salt, or a chew of salted or smoked herring before taking; 5, With soup or made into bread, jelly, etc. If oil nauseates, give before each dose potassium cyanide gr. ⅛ (.008 Gm.), or lime water ʒiv (15 Ml. (Cc.)), or bismuth subnitrate gr. 15–30 (1–2 Gm.).

Allied Oils:

1. *Oleum Squali, Shark Oil.*—From the liver of the shark—*Squa'lus Carcha'rias;* light yellow, limpid at —6° C. (21.2° F.).

2. *Oleum Rajæ, Ray Oil, Skate Oil.*—From livers of *Ra'ja Ba'tis.* France, Belgium; pale yellow, said to contain more iodine than cod liver oil.

3. *Oleum Ceti, Sperm Oil.*—From *Physeter macrocephalus;* yellowish, in cold deposits spermaceti and stearin.

4. *Oleum Balænæ, Whale Oil.*—From *Balæ'na mystice'tus* and *B. austra'lis;* deposits at 10° C. (50° F.).

Allied Animals and Products:

1. *Ichthyocolla, Isinglass.*—The swimming-bladder of *Acipen'ser Hu'so,* and other species, official 1820–1900. Sturiones. Large fish, 4–4.5 M. (12–15°) long, weighing 1,000 pounds (455 Kg.) or more, and ranking with whales as regal or royal fishes. Swimming-bladder (isinglass) occurs in separate sheets or rolled, horny, pearly, whitish or yellowish, semi-transparent, iridescent, inodorous, insipid; 1 part + 24 boiling water forms on cooling a transparent jelly. This swimming-bladder ("sound") is a membranous bag (in front of the abdomen of most fishes) containing oxygen and nitrogen in various proportions, which enables the fish, by contracting or expanding, to lower or raise themselves in water; this bag consists of 3 coats: 2 inner

(thin, delicate), 1 outer (tough, silvery-white); this latter is scraped off, discarded, and the inner bladder dried by (1) stretching into sheets, *leaf isinglass,* (2) folding several together, *book isinglass,* or (3) folding up around pegs, *long* or *short staple isinglass;* contains gelatin (glutin), insoluble membrane 2–30 p. c., ash .5 p. c.; solvents: boiling water, boiling diluted alcohol. Emplastrum Ichthyocollæ (Court Plaster)—Dissolve isinglass 10 Gm. in hot water q. s. 120 Gm.; with brush spread half of this in successive layers upon taffeta (stretched), add to other half alcohol 40 Gm., glycerin 1, apply as before, coat reverse side with tincture of benzoin. Nutritious, emollient, protective. Used in bowel derangements (children), mixed with farinaceous food, in clarifying liquors, to impart lustre to fabrics, as a test for tannin; plaster for cuts, abrasions, skin eruptions. Dose, *ad libitum;* Coxe's, Nelson's, as dietetic.

2. *American Isinglass.*—Sounds of *Ga'dus merluc'cius* (Hake) and *Otol'ithus rega'lis* (Weakfish), dried in thin sheets or ribbons.

3. *Purse* or *Pipe Isinglass.*—Dried fish-sounds without being cut open. Used sometimes in the arts as isinglass.

4. *Japanese* or *Chinese Isinglass* (Agar-agar).—A vegetable product from *Gracila'ria* (*Sphærococ'cus*) *lichenoi'des,* and other marine Algæ, see page 56.

5. *Chondrin.*—This resembles gelatin, being from cartilages of the ribs and other non-ossifying cartilages; its aqueous solution is precipitated by alum, lead acetate, ferric salts, acetic and mineral acids, but not by tannin or mercuric chloride; used as emollient, nutritive, protective, as the basis for suppositories, pessaries, bougies, capsules, lozenges, pill-coating, etc. Differs from gelatin in containing less nitrogen, more oxygen, in precipitating with acetic and mineral acids, but not with tannin.

6. *Ovi Vitellum Recens, Fresh Egg Yolk.*—The yolk of the egg of *Gal'lus Ban'kiva* var. *domes'ticus,* official 1880–1900. Gallinæ. Java, Cochin-China; domesticated. Animal, known as the domesticated or dunghill fowl, originated from the red jungle-fowl, to which our nearest approach is the game-cock. The eggs give 3 pharmaceutical products —*shell* 10 p. c., *albumen* 60 p. c., *yolk* 30 p. c. Yolk of egg (vitellus) is a viscid, yellow, opaque, alkaline liquid—being an emulsion of oil suspended in water by albumen; coagulates by heat and upon the addition of alcohol; gives whitish emulsion with water; yields to ether yellow fat and separates a white mass; odorless, bland taste; contains water 48–55 p. c., vitellin 16 p. c. (a proteid related to casein, mixed with albumen), fat 30 p. c., inorganic salts 1.5 p. c. (chlorides, sulphates, and phosphates of potassium, sodium, calcium, magnesium), cholesterin .42 p. c., lecithin, coloring matter, lactic acid, sugar. Glyceritum Vitelli—Rub fresh yolk of egg 45 Gm. in a mortar, with glycerin 55 Gm. gradually added, until thoroughly mixed. Nutritious, laxative; jaundice, dyspepsia; chiefly in pharmacy for emulsionizing oils, dressing for burns, scalds, abrasions, to soften cutaneous crusts, cerumen in the ear. Dose, 1–2 yolks.

7. *Ovi Albumen Recens, Fresh Egg Albumen.*—Weighs ℥v–6½ (20–25 Gm.); contains water 82–88 p. c., solids 12–18 p. c., mostly albumen, little fat, sugar, extractive, ash .65 p. c., of which 42 p. c. is KCl and 9 p. c. NaCl, the remainder being carbonates, phosphates, sulphates of alkalies, calcium, magnesium, and iron. It is nutritious, clarifies honey, syrup, and other liquids, is an antidote to metallic poisons (mercuric chloride, copper salts, etc.).

8. *Testa Ovi, Egg-shell.*—Composed of calcium carbonate 90–97 p. c., calcium and magnesium phosphates 1–5.7 p. c.; organic matter 2–4.7 p. c. It is antacid; once popular remedy for gravel.

CLASS 3: **MAMMALIA.** L. fr. *mammalis*, of the breast. The highest class of vertebrata. Distinguished by all being warm-blooded, viviparous, suckling their young by a mammary gland, nipples, breathing by lungs.

5. CETACEA. Cetaceous Family.

Se-ta'se-a. L. *cetus*, Gr. *κῆτος*, a whale—*i. e.*, pertaining or belonging to the whale. All animals of this family have pelvis and hind limbs somewhat atrophied, a fish-like body, specialized for aquatic progression, ending in a horizontal tail or flukes; short fore-limbs like fins or flippers, 1 at least of the digits with more than 3 phalanges; neck usually short; some of the cervical vertebræ anchylosed together.

Genus: **1. Physeter.**

CETACEUM. SPERMACETI.

Physeter macrocephalus, *Linné.* { A concrete, fatty substance from the head of the sperm whale.

Habitat. The Pacific and Indian Oceans.

Syn. Cetac., the Sperm Whale; Fr. Blanc de Baleine, Cétine, Spermacéti, Ambre blanc; Ger. Cetaceum, Walrat, Spermaceti, Wallrath.

Phy-se'ter. L. fr. Gr. *φυσητήρ*, a blow-pipe, a kind of whale; *φυσᾶ*, a pair of bellows, wind; *φυσᾶν*, blow—*i. e.*, the sperm whale has a blow-hole near the edge of the snout.

Mac-ro-ceph'a-lus. L. fr. Gr. *μακρής*, large, + *κεφαλή*, head—*i. e.*, animal has a very large head.

ANIMAL.—Usually 18–24 M. (60–80°) long, enormous head, being often 9 M. (30°) in circumference, and composing one-third its whole length; in front of the cranium the upper jaw has a large cavity containing an oily liquid, which, being removed in buckets shortly after death, congeals into a yellow mass. It is drained in suitable bags, pressed to remove oil, press-cake purified by melting in water, impurities skimmed off, boiled with weak potassium hydroxide solution, washed with water, and allowed to congeal.

CETACEUM, SPERMACETI.—This (as thus congealed) is in white, somewhat translucent, slightly unctuous masses of scaly-crystalline fracture, pearly lustre, faint odor, bland, mild taste, yellowish and rancid on exposure, sp. gr. 0.940, melts at 50° C. (122° F.), soluble in boiling alcohol, ether, chloroform, carbon disulphide, fixed or volatile oils, slightly in petroleum benzin, insoluble in water, nearly so in cold alcohol. *Impurities:* Paraffin; stearic acid.

Constituents.—Mainly cetylic alcohol or ethal, $C_{16}H_{33}OH$, combined with palmitic acid, $HC_{16}H_{31}O_2$, forming a fat, cetin (cetyl palmitate), $C_{16}H_{33}.C_{16}H_{31}O_2$, also small amounts of fat containing stearic, myristic, and lauro-stearic acids.

Preparations.—1. *Unguentum Aquæ Rosæ*, 12.5 p. c.

Unoff. Prep.: Ceratum, 10 p. c., + white wax 35, olive oil 55.

Properties and Uses.—Lenitive, demulcent, emollient, as a basis for ointments, cerates, etc., alvine and urinary derangements. May be given in emulsion with egg-yolk or almond oil, or powder made by rubbing down with alcohol or little almond oil.

Derivative Product:

1. *Ambra Grisea, Ambergris.*—This is a morbid excretion found in the intestines of the sperm whale, also floating on the sea; a single whale has produced 750 pounds (340 Kg.). It is in irregular masses, brownish-gray color, with lighter and darker streaks and spots, fusible in hot water, friable in the cold, sp. gr. 0.800–0.920; soluble in ether, fats, volatile oils, hot alcohol, insoluble in potassium hydroxide solution; odor peculiar, fragrant, nearly tasteless; contains ambreïn (fatty substance resembling cholesterin) 85 p. c., balsamic extractive, sodium chloride, benzoic acid (?), coloring matter, little ash. Used as stimulant, antispasmodic, mostly in perfumery, for fixing odor. Dose, gr. 5–15 (.3–1 Gm.).

6. PACHYDERMATA. Pachyderma(l)-tous Family.

Pak-i-der′ma-ta. L. fr. Gr. παχύς, thick, + δέρμα(τ), skin. All animals of this family have thick skin, are non-ruminant (do not chew the cud), ungulate mammals, or hoofed quadrupeds, such as elephants, hippopotamuses, swine, rhinoceroses, hyraxes, tapirs, horses, etc.

Genus: **1. Sus.**

SUS SCROFA. THE HOG.

1. Adeps. Lard.
2. Pancreatinum. Pancreatin.
3. Pepsinum. Pepsin.

Sus scrofa var. **domesticus,** *Gray.*

1. The purified internal fat of the abdomen of the hog. 2. A mixture of enzymes (principally amylopsin, trypsin, steapsin—unorganized ferments found in the pancreas of warm-blooded animals) obtained from fresh pancreas of the hog, or ox. 3. A mixture containing a proteolytic enzyme (ferment) obtained from glandular layer of the fresh stomach of the hog.

Habitat. Domesticated from the wild boar and closely related forms; universal.

Syn. 1. Br. Adeps Præparatus, Axungia, Axungia Porci (Porcina), Prepared (Hog's) Lard; Fr. Axonge, Graisse de Porc, Saindoux; Ger. Adeps suillus, Schweineschmalz. 2. Pancreat.; Fr. Pancreatine (médicinale); Ger. Pancreatin. 3. Fr. Pepsine; Ger. Pepsin.

Sus. L. fr. Gr. ὗς, a hog, pig—*i. e.*, the Linnean name of the genus.

Scrof'a. L. a breeding sow—*i. e.*, its classic name.

Do-mes'ti-cus.—L. domesticated, belonging to the household, fr. *domus*, house.

Animal.—About .6–1.3 M. (2–4°) long, .3–1 M. (1–3°) high, weighing from 15–800 pounds (7–365 Kg.), sometimes with side tusks (long canines); color iron-gray, white, or black, with long, drooping ears and more or less elongated snout. It is very important to man for its meat, fat, and entrails.

I. Lard: This fat is from the mesentery, omentum, and kidneys of winter-killed hogs; it is deprived of blood, external membranes, cut into small pieces, and heated on water-bath until melted, then strained through flannel. To make inodorous, may add to each pound (.5 Kg.) of melted lard, alum 15 gr. (1 Gm.) and sodium chloride 30 gr. (2 Gm.), boil until scum rises, remove this, strain, cool, work on slab with a stream of water to remove salts, remelt, and heat until all water is dissipated, It is a soft, white, unctious solid, faint odor; non-rancid, bland taste; soluble in ether, chloroform, carbon disulphide, petroleum benzin, slightly in alcohol, insoluble in water; melts at 40° C. (104° F.) to clear liquid, from which no aqueous layer separates. *Tests:* 1. Boil with distilled water—latter not alkaline (abs. of alkalies). 2. Boil 1 Gm. with alcohol (20), cool, filter, + few drops of saturated alcoholic solution of silver nitrate—slight turbidity (abs. of chlorides). *Impurities:* Alkalies (Na_2CO_3), chlorides (NaCl), free fatty acids, cottonseed oil (fats), tallow, etc. Should be kept cool in well-closed containers impervious to fat.

Constituents.—Olein (Oleum Adipis, U. S. P. 1900) 50–60 p. c., palmitin, stearin.

Preparations.—1. *Adeps Benzoinatus.* Benzoinated Lard: lard 100 Gm., Siam benzoin 1 Gm. See page 459.

Preps.: 1. *Ceratum.* Cerate. (Syn., Cerat., Simple Cerate, Ceratum Simplex (Adipis); Fr. Cerat simple; Ger. Unguentum cereum, Wachssalbe, Einfaches-cerat.)

Manufacture: Melt on water-bath white wax 30 Gm., add benzoinated lard 70 Gm., heat until liquefied, strain, stir constantly until congealed. When for hot-weather use, may replace 5–10 p. c. of benzoinated lard by white wax.

2. *Unguentum.* Ointment. (Syn., Ung., Simple Ointment, Unguentum Simplex (Adipis); Fr. Pommade simple; Ger. Unguentum cereum, Wachssalbe.)

Manufacture: Melt white wax 20 Gm., add benzoinated lard 80 Gm., heat gently until liquefied, stir until congealed. When for hot-weather use, may replace 5–10 p. c. of benzoinated lard by white wax.

Preps.: 1. *Unguentum Acidi Tannici*, 60 p. c. 2. *Unguentum Gallæ*, 80 p. c. 3. *Unguentum Phenolis*, 97.75 p. c.

3. *Ceratum Cantharidis*, 20 p. c. 4. *Unguentum Belladonnæ*, 55 p. c. 5. *Unguentum Chrysarobini*, 94 p. c. 6. *Unguentum Hydrargyri*, 25 p. c. 7. *Unguentum Iodi*, 80 p. c. 8. *Unguentum Iodoformi*, 90 p. c. 9. *Unguentum Stramonii*, 65 p. c. 10. *Unguentum Sulphuris*, 85 p. c. 11. *Unguentum Zinci Oxidi*, 80 p. c.

Unoff. Preps.: Ceratum Camphoræ, 40 p. c. *Unguentum Plumbi Iodidi*, 90 p. c. *Unguentum Potassii Iodidi*, 80 p. c. *Unguentum Sulphuris Alkalinum*, 65 p. c. *Unguentum Veratrinæ*, 90 p. c.

2. *Ceratum Resinæ*, 50 p. c. 3. *Unguentum Hydrargyri Nitratis*, 76 p. c. 4. *Unguentum Picis Liquidæ*, 35 p. c.

Unoff. Preps.: Unguentum Camphoræ, 67 p. c. *Unguentum Picis Compositum*, 32 p. c. *Unguentum Sulphuris Compositum*, 30 p. c.

PROPERTIES AND USES.—Lard is emollient. Employed mostly externally as a basis for ointments, cerates, and to preserve softness of poultices. The benzo(in)ated lard does not become rancid quickly by exposure, consequently this property and its odor particularly commend it.

II. PANCREATIN (Zymine): This may be extracted similarly to pepsin by macerating the finely minced fresh pancreas (sweet-breads) in acidulated (HCl) water, and separating with sodium chloride, or may be mixed with cold water, kneaded for an hour, filtered through flannel, and equal volume of alcohol added; the precipitate is drained, dried on trays at 40° C. (104° F.), then powdered. If instead of the water we use water saturated with chloroform, decomposition will be retarded greatly; may also rub up the product with sugar of milk without heat, which will keep it dry and prevent decomposition. It is a cream-colored, amorphous powder, faint, characteristic, but not offensive odor, slowly and incompletely soluble in water, insoluble in alcohol; acts best in neutral or faintly alkaline media; more than traces of mineral acids or large amounts of alkali hydroxides render it inert, while excess of alkali carbonates and pepsin solutions are inhibitory. It consists principally of amylopsin, myopsin, trypsin, steapsin, rennin, and is capable of converting at least 25 times its weight of starch into soluble carbohydrates—dextrins and sugars that are soluble in water; the myopsin and trypsin—changes proteins (albuminoids) into proteoses (peptones), the amylopsin—starch into dextrins and sugars, the steapsin—emulsifies fat, and the rennin (renfer)—coagulates milk. *Test:* 1. 5 gr. (.3 Gm.) should emulsify cod liver oil (4 Ml. (Cc.)). *Impurities:* Fat, etc. When of a higher digestive power it may be reduced to the standard with sugar of milk. It should be kept in well-closed containers. Dose, gr. 5–15 (.3–1 Gm.).

PROPERTIES AND USES.—It was used first in medicine for its emulsifying properties, hence of service as a ferment in dyspepsia and in the pre-digestion of food. Useful to assist the digestion of infants, invalids, old persons, and those prostrated by fever or exhaustion. Thus to peptonize or pre-digest, take pancreatin gr. 5 (.3 Gm.), sodium bicarbonate gr. 20 (1.3 Gm.), warm water ℥j (30 Ml. (Cc.)); when dissolved put into warm milk Oj (.5 L.), and keep temperature at 43° C. (110° F.) for an hour.

III. Pepsin: This may be made by several processes (yielding two kinds—*precipitated* and *scale* or *soluble*), each producing pepsin of different digestive strength. The original method consisted in chopping up finely the inside mucous membrane of the pig's stomach and macerating it in acidulated (HCl) water for several days, the liquid portion is strained off, and to it sodium chloride is added; this precipitates the pepsin, which, rising to the surface, is skimmed off, pressed, and dried. A more modern method employs sodium sulphate (instead of sodium chloride), which, together with peptone, is removed by dialysis, then residual solution concentrated and dried on glass plates. It is in lustrous, white, pale yellow, yellowish, transparent, translucent scales, grains, spongy masses, or a fine, white, cream-colored, amorphous powder, free from offensive odor, slightly acid or saline taste, slightly hygroscopic; soluble in water (50), solution acid and opalescent, nearly insoluble in alcohol, chloroform, ether; solutions incompatible with alkalies, alkali earths, alkali carbonates, and the presence of hydrochloric acid beyond .5 p. c. inhibits its proteolytic activity, as do alcohol, and heat (70° C.; 158° F.); precipitated from solutions by tannic or gallic acid, and by salts of many heavy metals, incompatible with pancreatin, this in neutral or alkaline solution destroying pepsin, while in acid media being destroyed by the pepsin. It digests at least 3,000 times its own weight of freshly coagulated and disintegrated egg albumen—converts nitrogenous food (proteids—albumen, casein, fibrin, muscle) into albumoses and finally into soluble peptones; acts only in acid media, but when acid solutions are heated to 100° C. (212° F.) they lose all proteolytic power, becoming milky or with light flocculent precipitate; if in dry state not injured by above heat. When of a higher digestive power it may be reduced to the standard with pepsin of a lower digestive strength or sugar of milk. Should be kept in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.).

Preparations.—(Unoff.): *Pulvis Pancreatini Compositus*, 20 p. c., + sodium bicarbonate 80. *Liquor Prancreatini*, 1.75 p. c., + sodium bicarbonate 5, glycerin 25, comp. spirit of cardamom .35, alcohol 6.5, magnesium carbonate .8, sodium chloride .5, chloroform .2, dist. water q. s. 100. *Pepsinum Saccharatum*, official 1880–1900, 10 p. c., + sugar of milk 90, dose, gr. 5–60 (.3–4 Gm.). *Elixir Pepsini*, 1.75 p. c. (glycerite 20, glycerin 10, hydrochloric acid .4, aromatic elixir q. s. 100. *Elixir Pepsini, Bismuthi et Strychninæ*, strychnine .0175 p. c., + tartaric acid .0175, elixir of pepsin and bismuth q. s. 100. *Elixir Pepsini et Bismuthi* .85 p. c., + glycerite of bismuth 12.5, glycerin 12.5, +. *Elixir Pepsini et Ferri*—tinct. ferric citro-chloride 75 p. c., elixir of pepsin q. s. 100. *Elixir Pepsini et Rennini Compositum*, 2.25 p. c., + rennin 1.65, lactic acid .2, +. *Liquor Pepsini*—glycerite of pepsin 5, hydrochloric acid 1, glycerin 31.5, dist. water q. s. 100. *Liquor Pepsini Aromaticus*, 1.75 p. c., + hydrochloric acid 1, +. *Liquor Pepsini Antisepticus*, 5 p. c., + dil. hydrochloric acid 2, +. *Vinum Pepsini*—glycerite of pepsin 20 p. c., alcohol 10, sherry wine 70.* Dose, each ʒj–4 (4–15 Ml. (Cc.)). *Glyceritum*, 8.5 p. c., + hydrochloric acid 1, glycerin 50, +.

Properties and Uses.—As a ferment to assist gastric digestion in persons having deficient secretion of gastric juice, in old persons during convalescence from lung illness, cancer of stomach, diarrhœa, diabetes; does not aid digestion of fats or carbohydrates. Should be given after meals, and followed half-hour afterward by dose of hydrochloric acid.

Allied Products:

1. *Renninum, Rennin.*—Partially purified milk-curdling enzyme from glandular layer of the calf's stomach (*Bos taurus*), coagulating 25,000 times its weight of fresh milk. It is a yellowish-white powder, grains, scales, saline taste, peculiar odor, soluble in water, dil. alc., hygroscopic; may reduce higher strength with sodium chloride and sugar of milk; with iodine T. S.—no blue; deteriorates rapidly, must be kept cool, in well-stoppered, amber-colored bottles.

2. *Papayotin, Papain, Caricin.*—Albuminous ferment from the fruit of the melon tree or Pawpaw (*Car'ica Papa'ya*). Tropical America. Tree 6 M. (20°) high, stem 30 Cm. (12′) thick, fruit approximates the size of one's head, and contains an acrid, astringent, bitter, milky juice, which soon separates into a coagulum and aqueous liquid, from which latter papayotin is precipitated upon the addition of alcohol. It is a whitish, hygroscopic powder, inodorous, tasteless, soluble in water, glycerin, active in neutral acid, but more so in alkaline solutions; it converts starch into maltose, albuminoids into peptones, and emulsifies fats; should digest 200 times its weight. Papoid, Caroid, etc., are weaker forms (dried juice); slightly inferior to pepsin, greatly inferior to pancreatin. Dose, gr. 2–5 (.13–.3 Gm.).

3. *Ingluvin.*—This is claimed to be a bitter principle contained in the fowl's gizzard, and again—simply the gizzards cleaned, dried, and pulverized. Dose, gr. 5–15 (.3–1 Gm.).

7. RUMINANTIA. Ruminant Family.

Ru-mi-nan'shi-a. L. fr. *ruminan(t)s*, ruminating, chewing the cud. All animals of this family (bos, camel, deer, neat cattle, sheep, etc.) are hoofed quadrupeds, cloven-footed, even-toed, with 4 stomachs, or 1 with 4 divisions. Food being slightly masticated goes to No. 1 stomach, where it is ground finer; now passes to No. 2, where it is formed into balls, which are returned to the mouth and chewed again, constituting the cud; thence the food passes to Nos. 3 and 4 stomachs, where it is digested and assimilated.

Genus: **1. Moschus. 2. Ovis. 3. Bos.**

MOSCHUS. MUSK.

Moschus moschiferus, *Linné.* { The dried secretion from the preputial follicles.

Habitat. Central Asia, from India to Siberia, Thibet; Himalayas, 900–4,200 M. (3,000–14,000°) elevation.

Syn. Mosch., Tonquin Musk, Deer Musk, Moschus Orientalis—Sinensis (Chinensis)—Tibetanus; Fr. Musc.; Ger. Moschus, Bisam.

Mos'chus. L. musk. Gr. *μόσχος*, fr. Skt. *mushka*, testicle, orig. a little mouse.

Mos-chif'e-rus. L. *moschus*, musk, + *ferre*, to bear—*i. e.*, musk-producing.

ANIMAL.—About 1 M. (3°) long, .6 M. (2°) high, haunches higher than shoulders, having a canine tooth (tusk) from the upper jaw, on either side, projecting downward 2 inches out of the mouth, which is curved backward and serves to extract roots and other food material; ears long, narrow; hair undulated, strong, elastic, iron-gray, whitish toward the root, blackish near the apex. SECRETION (musk), in small, irregular granules, 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, blackish with a few brown fragments, grayish on aging; glistening, somewhat oily; odor peculiar, penetrating, powerful, persistent; taste somewhat bitter. *Tests:* 1. A few granules in water 2 Ml. (Cc.), in a watch-crystal, stirred with a glass rod—light brown solution, with undissolved portion of fine granules, numerous rod-like bacteria, few hyphæ of a fungus; in 2 Ml. (Cc.) of alcohol grains sink, on stirring with glass rod—pale brown, slightly cloudy solution, leaving oily stain upon evaporating and undissolved portion less disintegrated than with aqueous mixture; in 2 Ml. (Cc.) of chloroform grains float—on stirring with glass rod solution nearly colorless, which upon evaporation separates around the particles a whitish, oily (fatty) substance. 2. At least 50 p. c. soluble in water (solution having strong characteristic odor and slight acid reaction); 10 p. c. soluble in alcohol (solution yellowish-brown, slightly turbid upon adding water); 15 p. c. of moisture (lost by drying in desiccator over sulphuric acid). *Solvents:* diluted alcohol; ether; hot water partially. Dose, gr. 1–10 (.06–.6 Gm.).

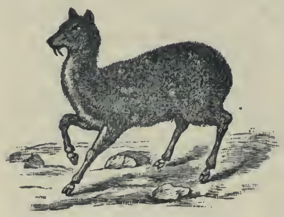


FIG. 439.—Musk deer.

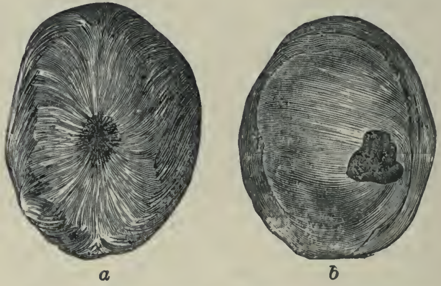


FIG. 440.—Chinese musk sac; *a*, lower surface; *b*, upper surface.

Adulterations.—Artificial musk bags made of hairy skin and filled with foreign substances; these possess none of the characteristics belonging to the true bag as previously described. Often the natural sacs are opened, the secretion in part or whole abstracted, and the sac refilled with dried blood, resin, lead, sand, iron filings, hair, bird dung, wax, storax, benzoin, asphaltum, artificial musk, starch, etc.; in these sacs the sewed-up seam should at once excite suspicion, and lead to testing the contents.

Commercial.—The musk deer, in spite of having no horns but a tusk on each side, resembles closely our own deer in shape, size, and habits, being timid, active, fleet-footed and apparently intelligent; it inhabits the pine forests of high mountains, seeking inaccessible snowy recesses and cliffs, hiding by day and searching for food at night, owing to which, although abundant, comparatively few are captured (20,000 annually, male and female), and then only by snares, pitfalls, or shooting. It is hunted for the hide and secretion (musk) found in a projecting, hairy sac (bag, pod, pouch) between the umbilicus and prepuce of male animals, being 5–7.5 Cm. (2–3′) long, 2.5–5 Cm. (1–2′) broad, upper side flat with smooth membrane, under side convex, covered with stiff appressed, grayish hairs concentrically arranged around 2 orifices near the centre, the anterior small, hairy, the posterior marked by a furrow corresponding with the opening of the prepuce, and the interior lined by a smooth membrane, much convoluted to form incomplete partitions, which produces the secretion. As soon as killed the sac is cut off, dried by pressing against heated stones, and sent into market, those of well-developed adults yielding 2–6 drachms (8–24 Gm.) of chocolate-brown, thickish liquid secretion, that of the young deer being milky. There are several varieties: 1, *Tonquin* (*Chinese, Thibet*), best, claimed to come from Tonquin, but much from Yun-Nan, S. China, shipped via Shanghai, some via Calcutta, in lead-lined boxes containing 25 sacs, nearer round than all others, each wrapped carefully in paper; 2, *Siberian* (*Russian*), sometimes scarcely inferior to the Tonquin, but generally weaker, and with a more fetid odor and ammoniacal smell; enters commerce via Petrograd (St. Petersburg); when in flat, oval sacks, its usual form, with thin light hairs, it is known as *Cabardine;* 3, *Bucharian* (*Assam*), in small sacs, often with portions of hide adhering, rarely in our market; 4, *Canton* (*Tonquinol, Bauer, Artificial*), brown resinous mass capable of being powdered, musk-like odor, quickly lost on exposure; it is trinitro-isobutyl-methyl-benzol, obtained by acting on tertiary butyltoluene with nitric and sulphuric acids, heating for 8 hours, or by treating rectified oil of amber with fuming nitric acid. The homologues of isobutylxylol have an analogous odor.

Constituents.—Volatile oil .5–2.07 p. c., ammonia, an acid, cholesterin, fat, wax, gelatinous and albuminous principles, ash 8 p. c. —mostly NH_4, Ca, K—chlorides. The odorous principle is believed to be more than the volatile oil, and as yet has not been determined definitely; it volatilizes partly with steam, and is formed probably by slow continuous decomposition of one of the constituents in the presence of moisture; this is so powerful that a few grains, well protected, will impregnate a room for years without material loss of weight; also 1 part will saturate strongly 3,000 parts of an inodorous powder. This odor, however, may be removed by triturating with camphor, hydrocyanic acid, ergot, fennel or oily seeds, or by prolonged drying over sulphuric acid, but odor returns upon absorbing moisture. The German Pharmacopœia requires musk dried by this last process. Alkalies render musk more soluble and the odor more pronounced.

Preparations.—1. *Tinctura Moschi.* Tincture of Musk. (Syn., Tr. Mosch.; Fr. Teinture de Musc; Ger. Moschustinktur.)

Manufacture: 5 p. c. Triturate to smooth paste musk 5 Gm. with water 45 Ml. (Cc.), gradually added, macerate in bottle for 24 hours, add alcohol 45 Ml. (Cc.), macerate for 6 days, occasionally shaking, transfer to a plain paper filter, drain, wash residue on filter with diluted alcohol q. s. 100 Ml. (Cc.). Dose, ʒss–2 (2–8 Ml. (Cc.)).

Unoff. Preps.: Emulsion. Enema. Pill (Pilula). Suppositories.

Properties.—Antispasmodic, nervine, anodyne, diffusible stimulant, aphrodisiac—similar to valerian, asafetida, camphor, ammonia. Acts directly on the heart and nervous system, producing alcoholic symptoms, stimulates respiratory centre; may cause headache, nausea.

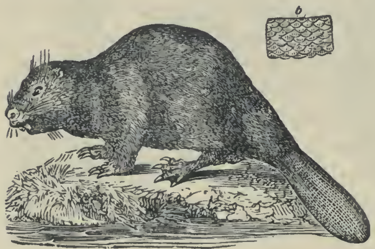


Fig. 441.—*Castor Fiber: b*, scales of the tail.

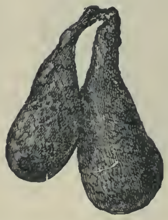


Fig. 442.—Castor follicles: one-fourth natural size.

Uses.—Typhoid fever, typhus and eruptive fevers, pneumonia, infantile convulsions, hiccough, pharyngeal spasms, spasmodic croup or cough, whooping-cough, vomiting, colic, hysterical convulsions, tetanus, delirium tremens, rheumatism, cholera infantum, false croup; externally in plaster for muscular rheumatism, sprains, etc.

Allied Animals:

1. *Cas'tor Fi'ber, Castoreum, Castor, Beaver.*—Rodentia. The dried preputial follicles, and their secretion, obtained from the male and female animal, separated from the frequently attached shorter and smaller oil sacs, official 1820–1880; Canada, Russia. Beaver is about .6–.8 M. (2–2½°) long; tail 25–30 Cm. (10–12′) long, 7.5–10 Cm. (3–4′) wide, flattened, hairy at base, scaly at end; head like a rat's; has no canines, but 2 incisors, 4 molars all around for gnawing; hair brownish. The American or Canadian is smaller, with darker fur, follicles weigh

1–4 ounces (.03–.12 Kg.), and are used mostly. Russian or Siberian has follicles pyriform, 2–8 ounces (.06–.24 Kg.); odor more agreeable, 7.5 Cm. (3′) long, club-shaped, in pairs, wrinkled, brown; contents brown, hard, friable. Alcohol dissolves one-half, giving brown tincture, turbid on adding water, clarified by ammonia; contains volatile oil, having phenol 1–2 p. c., resinous substance (bitter) 14–58 p. c., castorin, salicin, osmazone, urates, benzoates, cholesterin, ash 3.5 p. c. Used as stimulant, antispasmodic, emmenagogue, for hysteria, fevers, epilepsy, typhoid, amenorrhœa; in decoction, tincture. Dose, gr. 10–30 (.6–2 Gm.). It is weaker than musk, and presents no advantage over valerian, camphor, ammonia, ether, etc. It is adulterated with blood, resins, minerals, calcium carbonate, goat scrotums, etc., sometimes to 50 p. c. The oil-sacs furnish our once official *Axungia Castoris.*

2. *Cer′vus El′aphus, Cornu Cervi, Stag's Horn, Hart's Horn.*—The horn of the stag, a species of deer, official 1820–1840. The hard, bony horns yield by boiling with water a transparent, colorless, inodorous jelly, and then incineration (of cleaned bones) gives pure calcium phosphate, which was mixed with antimony sulphuret and subjected to white heat, yielding antimony oxide and calcium phosphate; as such was a component of our (once official) first-made antimonial or James' powder.

3. *Antil′ope Dor′cas.*—N. Africa. Deer-like, ruminant animal, whose globular excrements have strong musk-odor, for which it is used in perfumery. *Hy′rax capen′sis, Hyraceum,* S. Africa. The dry excrements of the badger or klipdas, a mammal .5 M. (18′) long, black. When hot has castor oil odor; partly soluble in water, less so in alcohol, ether.

4. *Civet′ta* and *Zib′ethum, Civet.*—Animal .6–1 M. (2–3°) long, .3 M. (1°) high, unctuous secretion in the pouch between anus and genitals of both sexes of *Viver′ra Civet′ta* and *V. Zib′etha,* Africa, S. Asia. These are grown for secretions, which are removed by ladles; it is at first yellow, then dark brown. Like musk medicinally, but mostly used in perfumery.

OVIS ARIES. THE SHEEP.

1. SEVUM PRÆPARATUM. Prepared Suet.
2. ADEPS LANÆ. Wool Fat.

Ovis aries, *Linné.* 1. The internal fat of the abdomen of the sheep, purified by melting and straining. 2. The purified fat of the wool of sheep, freed from water.

Habitat. Domesticated, and form a variety from either the Siberian (*Ovis Ammon*) or S. Europe sheep (*Ovis Musimom*).

Syn. 1. Sev. Præp., Mutton Suet, Sevum; Fr. Suif (Graisse) de Mouton Purifié; Ger. Sebum ovile (ovillum), Hammeltalg, Talg. 2. Adeps Lan., Anhydrous Lanolin, Lanolinum, Lanolin (L. *lana,* wool, + *oleum,* oil, + *in*), Agnin, Oesipus, Oesipum, Woolfat; Fr. Suint de Laine; Ger. Woolfett, Adeps Lanæ anhydricus, Wollfett.

O′vis. L. sheep, fr. Gr. ὄις, a sheep, from which comes our ewe—*i. e.,* original name.

A′ri-es. L. a ram. fr. OE. *ares*—*i. e.,* the original name for the male species.

Animal.—This is one of the most useful animals to man. The male is a ram, the female an ewe, and the young a lamb; the flesh of the latter is called lamb, that of the adult mutton; the fleece is wool, the principal component of our warm clothing; the prepared hide is the useful sheepskin; the entrails furnish sausage skins, and when dried (catgut) are twisted into musical instrument strings. In addition to all these we have the two official products as above named. There are many varieties of sheep, but the most important are: 1, Leicester; 2, Cotswold; 3, Southdown; 4, Cheviot; 5, Astrakhan; 6, Cretan; 7, Merino.

I. Prepared Suet: This is taken chiefly from around the kidneys, and is prepared by freeing from adhering membrane and blood, cutting into pieces, melting carefully, and straining through cotton or flannel; may also boil it in water, when it rises to the surface, leaving the water and impurities as a substrata. It is a white, solid fat, nearly inodorous, bland taste when fresh, rancid on prolonged exposure to air, insoluble in water, cold alcohol, soluble in boiling alcohol (44), ether (60), slowly in purified petroleum benzin (2), from which, on standing, it slowly separates in crystalline form; alcoholic solution neutral, slightly acid to litmus paper moistened with alcohol; melts at 47° C. (117° F.), congeals at 39° C. (102° F.). *Impurities:* Free acid, etc. Should be kept in well-closed vessels impervious to fat, and not used when rancid.

Constituents.—Stearin and palmitin 70 p. c., olein 30 p. c., hircin a trace.

Preparations.—1. *Unguentum Hydrargyri,* 23 p. c.

Unoff. Preps.: Sevum Benzoinatum, 3 p. c. (benzoin), prepared suet 100, heat, strain. *Ceratum Resinæ Compositum,* 30 p. c. *Unguentum Fuscum,* 25 p. c.

Properties and Uses.—Lenitive, when rancid an irritant; chiefly in cerates, ointments, plasters, as it is thicker than lard, for dressing blisters, excoriated surfaces, chapped hands, etc.

Allied Fat:

1. *Sevum Bovinum, Beef Tallow.*—This is the internal fat of *Bos taurus;* it is similar to the preceding, except that it has a slightly different odor; melts at 40° C. (104° F.), and contains more palmitin, and no hircin.

II. Wool Fat: Sheep's wool contains much fat, usually 45 p. c. of its weight, which must be removed before the wool is suitable for fabrics. This is accomplished by macerating the wool in several waters, preferably boiling, collecting of each the supernatant fat layer, mixing them, straining through linen, exposing to sun until bleached white; sea-water may be employed, skimming off foam and kneading it with hands in the sun; it may be purified by treating with weak alkali solutions, centrifuging the resulting emulsion, thereby separating a lower aqueous layer (soap solution of impure fatty acids) and an upper creamy layer (cholesterin, fats), which upon removal and treatment with calcium chloride, separating and dehydrating the fat by fusing with unslaked lime, extracting mixture with acetone, and reclaiming same, yields a residue of pure wool fat. It is a light yellow, tenacious, unctuous mass; slight odor; insoluble in, but miscible with water (2), sparingly soluble in alcohol, more so in hot alcohol, soluble in ether, chloroform; melts at 40° C. (104° F.); vaporizes at higher temperatures, the vapor burning with luminous, sooty flame. *Tests:* 1. Dissolve in chloroform (1 in 50), pour upon sulphuric acid—deep brownish-red develops at line of contact of the layers; dry to constant weight—loses .5 p. c. of weight (abs. of water). 2. Incinerate 1 Gm.—ash .1 p. c., which is not alkaline to litmus (abs. of alkalies, soaps). *Impurities:* Alkalies (free), soaps, free fatty acids, chlorides, glycerin, water, petroleum, soluble oxidizable substances. Should be kept cool in well-closed containers impervious to fat.

Constituents.—Cholesterin, $C_{26}H_{43}OH$, isocholesterin, cerylic, carnaubic, lanolinic, and other alcohols, esters of lanopalmitic, myristic, carnaubic, oleic, and other acids, ash .3 p. c.

Preparations.—1. *Adeps Lanæ Hydrosus.* Hydrous Wool Fat. (Syn., Adeps Lan. Hyd., Lanolin, Lanolinum; Fr. Lanoléine, Graisse de Laine Hydratée; Ger. Adeps Lanæ cum Aqua, Wasserhaltiges Wollfett.)

Manufacture: Place in a warm mortar wool fat 70 Gm., add gradually with constant stirring, water 30 Ml. (Cc.). It is a yellowish-white, nearly white, ointment-like mass; slight odor; insoluble in, but miscible with water (2); with ether, chloroform—turbid, neutral solutions; contains 25–30 p. c. of water. *Test:* 1. When heated separates into upper oily and lower aqueous layer; heated on water-bath with stirring—residue 70–75 p. c., which is transparent when melted and on cooling remains a yellowish, tenacious, unctuous mass, soluble in ether, chloroform, sparingly in alcohol, and responds to tests of wool fat. Should be kept cool in well-closed containers impervious to fat.

Preps.: 1. *Unguentum Belladonnæ,* 30 p. c. 2. *Unguentum Hydrargyri Ammoniati,* 40 p. c. 3. *Unguentum Hydrargyri Oxidi Flava,* 40 p. c. 4. *Unguentum Stramonii,* 20 p. c.

Unoff. Preps.: Ceratum Plumbi Subacetatis, 20 p. c. *Unguentum Hydrargyri Oxidi Rubri,* 40 p. c. *Unguentum Resorcinolis Compositum,* 28 p. c.

Properties and Uses.—Lenitive. It is claimed to be absorbed by the skin more quickly than most fats, hence an excellent base for mercury and other medicines to be administered by inunction. Soothing to the skin and a good base for ointments, as it does not become rancid.

Derivative Products:

1. Suprarenalum Siccum. Dried Suprarenals, *official.*—(Syn., Supraren. Sicc., Glandulæ Suprarenales Siccæ, U. S. P. 1900, Desiccated Suprarenal Glands; Fr. Glandes Surrénales desséchées; Ger. Getrocknete Nebennieren.) The suprarenal glands of animals used for food by man (sheep, ox, pig, etc.) cleaned, dried, freed from fat, and powdered, and containing .4–.6 p. c. of epinephrine (active principle).

Manufacture: After removing all external fat and connective tissue the glands are dried as rapidly as possible in a current of warm air at a moderate temperature, and when sufficiently dry are reduced to a coarse powder, and the remaining fat removed by petroleum benzin; all moisture must be removed, by desiccation if necessary, to avoid subsequent putrefaction, after which residue is powdered finely and preserved in well-stoppered bottles. It is a light yellowish-brown, amorphous powder, slight, characteristic odor; partially soluble in water; contains not more than 7 p. c. of moisture; incinerate—ash 7 p. c.; 1 part represents 6 parts of fresh glands, free from fat.

Commercial.—The suprarenal or adrenal gland (body or capsule) of the sheep (ox, pig) is a small glandular, follicular body shaped like a cocked hat, and perched as a cap on the top of each kidney. The gland is not confined to the animals above mentioned, but is present in mammals and most other vertebrates, that in man being 2.5–5 Cm. (1–2′) long, less in width, and 6 Mm. ($\frac{1}{4}$′) thick; it consists of an outer yellowish cortical portion and a very dark inner medullary portion, and while ductless and of unknown function contains abundant bloodvessels, nerves, and lymphatics. They yield their active constituent to boiling water, or to a more or less saturated aqueous solution of boric acid, in which the medicinal properties may remain unimpaired for months. These solutions can readily be made 5–10 p. c., and when 1 Ml. (Cc.) represents 1 Gm. of the fresh gland we have what is recognized as Extractum Glandularum Suprarenales. Dose, gr. 3–15 (.2–1 Gm.); dried extract, gr. 1–3 (.06–.2 Gm.).

Epinephrine (adrenalin, adnephrin, adrin, suprarenalin, supracapsulin), the recognized active constituent, resides in the medulla of the gland, and when isolated is a yellowish-white, stable, alkaline, micro-crystalline powder, slightly bitter, benumbing points of contact on the tongue; turns brown when heated to 205° C. (401° F.), melts, decomposes, and swells at 207° C. (405° F.); readily soluble in most diluted acids and alkalies, slightly soluble in cold water, more soluble in hot water; colorless aqueous solutions easily oxidized by air, changing from pink to red and brown; forms salts (benzoate, hydrochloride, sulphate), each becoming a brown, brittle, deliquescent, amorphous mass.

PROPERTIES.—Astringent, hæmostatic, cardiac stimulant, vascular constrictor, muscle tonic, local anæsthetic, poisonous. Some ascribe to the gland a function—the removal and destruction of certain poisons from the blood, or the production of an active substance necessary for the maintenance of health. Lessens heart rate, causes a weak pulse to become strong, and an intermittent one regular, stimulates feeble cardiac muscle, has no action on normal heart, and no organic disease contraindicates its use, reduces size of thyroid; epinephrine is considered about 600 times stronger than the extract, and a solution (of it or its salt) 1 to 10,000 blanches normal conjunctiva within 30–60 seconds.

USES.—Locally to nose and throat to reduce congestion and hasten absorption of inflammatory tissue, rhinitis, hay fever, conjunctivitis, keratitis, iritis, ear affections, relieves deafness and tinnitus, hypertrophy of turbinated bodies (increases effect of cocaine), Addison's disease (characterized by fibro-caseous metamorphosis of suprarenal capsules, brownish-olive coloration of skin, anæmia, prostration), asthma, epistaxis, rickets, exophthalmic goitre, diabetes, anæmia, enlargement of spleen and liver, local vaso-constrictor in minor surgery.

2. **Thyroideum Siccum. Dried Thyroids**, *official.*—(Syn., Thyroid. Sicc., Glandulæ Thyroideæ Siccæ, U. S. P. 1900, Desiccated Thyroid Glands; Br. Thyroideum Siccum, Dry Thyroid; Ger. Getrocknete Schielddrüsen.) The thyroid glands of animals used for food by man (sheep, ox, pig, etc.) freed from connective tissue and fat, dried and powdered, and containing .17–.23 p. c. of iodine in thyroid combination.

Manufacture: Remove external fat and connective tissue from thyroid glands taken from sheep (ox, pig) immediately after killing, cut glands across, rejecting those that are hypertrophied or contain cysts or otherwise abnormal; mince finely the healthy glands, dry at 32–38° C. (90–100° F.), powder dried product, remove all fat by treating with petroleum benzin, dry residue. It is a yellowish, amorphous powder, slight, characteristic odor; must be free from iodine in inorganic or any other form of combination than that peculiar to the thyroid; contains not more than 6 p. c. of moisture, 5 p. c. ash, and 1 part corresponds to 5 parts of the fresh glands.

Commercial.—The sheep's thyroid gland, located about the first two tracheal rings, is 2-lobed, joined by a narrow band (isthmus) in front of the tracheæ, brownish-red, weighing 2 drachms (8 Gm.); contains thyroidin, iodoglobulin. The extract (Extractum Thyroidei) is made with glycerin (4 glands in each ounce; 30 Ml. (Cc.)), the solution heated with strong phosphoric acid, poured into lime water, precipitate dried. The solution (Liquor Thyroidei, Br.), made with glycerin, preserved with .5 p. c. aqueous solution of phenol, is pinkish, turbid, without putrescent odor; 100 minims (6 Ml. (Cc.)) represent one gland. Dose, gr. 5–10 (.3–.6 Gm.).

Thyreoidectin (Capsulæ Antithyroideæ) is a reddish-brown powder from blood of thyreoidectomized sheep (those with thyroid gland removed), used similar to the official product.

PROPERTIES AND USES.—Influences the processes of nutrition and metabolism, which at present is not understood; in health it is a circulatory sedative or depressant, causing loss of flesh when persisted in; often produces ill-health, wrinkling and changing skin from healthy appearance to a sallow hue. When taking full doses patient should remain in bed, owing to attending depression, which can be abated somewhat by strychnine; causes not only loss of fat, but nitrogenous tissue, hence persons must partake liberally of proteid diet. Dementia, acute mania, exophthalmic goitre.

BOS TAURUS. THE OX AND COW.

1. Fel Bovis. Oxgall.
2. Saccharum Lactis. Sugar of Milk, $C_{12}H_{22}O_{11} + H_2O$.

Bos taurus, *Linné.* { 1. The fresh bile of the ox. 2. Lactose, $C_{12}H_{22}O_{11} + H_2O$, from the whey of cow's milk.

Habitat. Domesticated; universal.

Syn. 1. Fel Tauri, Fel Bovinum, Bilis Bubula, Ox-bile; Fr. Bile (Fiel) de Bœuf; Ger. Ochsengalle, Rindsgalle. 2. Sacch. Lact., Milk sugar, Lactose; Fr. Sucre de Lait, Lactine; Ger. Milchzucker.

Bos. L. *bos, bovis,* fr. Gr. *βοῦς,* an ox—*i. e.,* its classic name.

Tau'rus. L. fr. Gr. *ταῦρος,* a bull, ox—*i. e.,* its classic name.

Animal.—Large, 2–3 M. (6–10°) long, 1–1.6 M. (3–5°) high, head low upon a short neck, legs relatively short, hoofs broad, muffle naked, horns unbranched, tail tufted at the tip, inguinal teats.

I. Bile (oxgall): This is separated by the liver in the gall-bladder; it is a brownish-green, somewhat viscid liquid, characteristic odor, disagreeable, bitter taste, sp. gr. 1.020, neutral, faintly alkaline. *Tests:* 1. Add alcohol—precipitate (mucilaginous matter), filter, evaporate off alcohol, when it resists putrefaction. 2. Mix 2 drops with water 10 Ml. (Cc.), + a drop of a fresh solution of sugar 1 and water 4, + sulphuric acid cautiously added until precipitate first formed is redissolved—brownish-red color, changing to carmine, purple, violet. Dose, inspissated bile, gr. 5–15 (.3–1 Gm.).

Constituents.—Water 85–90 p. c., solids 10 p. c.: Sodium and potassium glycocholates and taurocholates 6 p. c. (boiled with alkalies glycocholic acid splits into cholic acid and glycocoll, and taurocholic acid into cholic acid and taurin, $C_2H_7NSO_3$); bile pigments—bilirubin (orange-red), $C_{32}H_{36}N_4O_6$, oxidizing quickly into biliverdin (dark green), $C_{32}H_{36}N_4O_9$, bilifuscin (dark brown), biliprasin (greenish-black), bilihumin (blackish), bilicyanin (bluish), mucilage (precipitated by 2 vols. alcohol), cholesterin, $C_{26}H_{44}O$, choline, fat, albumin, soap, mucin, urea, salts.

Preparation.—1. *Extractum Fellis Bovis.* Extract of Oxgall. (Syn., Ext. Fel. Bov., Powdered Extract of Oxgall; Fr. Extrait Bile (Fiel) de Bœuf; Ger. Ochsengallextrakt.)

Manufacture: Macerate for 2 days 80 Gm. with alcohol 100 Ml. (Cc.), decant liquid, wash residue with alcohol 50 Ml. (Cc.), decant liquid, mix and filter the two liquids, reclaim alcohol, evaporate at 75–80° C. (167–176° F.) to thick extract, spread on glass plates, expose to warm air at 70° C. (158° F.), pulverize, add dried starch q. s. 10 Gm.; mix thoroughly, pass through fine sieve; 1 Gm. represents 8 Gm. of oxgall. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. 1–3 (.06–.2 Gm.).

Unoff. Prep.: Fel Bovis Purificatum, U. S. P. 1900; evaporate oxgall 300 to 100, add alcohol 100, mix thoroughly, after 3–4 days decant, filter, distil off alcohol, evaporate to pilular consistence, dose, gr. 5–15 (.3–1 Gm.).

Properties and Uses.—Tonic, laxative, cholagogue, antiseptic, vermifuge; constipation, especially when feces pale color, dyspepsia, jaundice; whenever biliary secretion is deficient; locally in glandular enlargements.

II. Lactose (sugar of milk): This is found only in mammal's milk, usually to the extent of about 5 p. c.; obtained mostly in Switzerland, Bavaria, etc., from whey of cheese-making; the butter and casein are removed, the latter by allowing time for oxidation and generation of lactic acid, or by adding to skimmed milk diluted sulphuric acid, evaporating the resulting whey to $\frac{1}{15}$ original bulk, when it is a brown, viscid, sweetly saline mass; this is put into large tanks or tubs, and in 1–2 days sugar crystallizes in bright yellow granules—*sugar sand*—the process being facilitated by the presence of thin sticks or cords; the impure crystals may be dissolved in water, decolorized by charcoal and recrystallized. It is in white, hard, crystalline masses or white powder, producing grittiness on the tongue, odorless, faintly sweet taste, permanent, readily absorbs odors, soluble in water (4.9), boiling water (2.6), insoluble in chloroform, ether, almost so in alcohol; aqueous solution (1 in 20) neutral, dextrorotatory. *Tests:* 1. Mix hot saturated aqueous solution and sodium hydroxide T. S. each 5 Ml. (Cc.), warm gently—liquid yellow, finally brownish-red; add few drops of cupric sulphate T. S.—precipitates (cuprous oxide). 2. Dissolve 3 Gm. in boiling distilled water 10 Ml. (Cc.)—solution odorless, clear, colorless, faintly yellow; incinerate 1 Gm.—ash .1 p. c. *Impurities:* Heavy metals, cane-sugar (sucrose, glucose—25–50 p. c.), dextrin, starch. Should be kept in tightly-closed containers. Dose, ℥j–5 (30–150 Gm.) + per die, in powder syrup.

Preparations.—1. *Ferri Carbonas Saccharatus*, 10 p. c. 2. *Pulvis Ipecacuanhæ et Opii*, 80 p. c. 3. *Trituratio Elaterini*, 90 p. c.

Properties and Uses.—Diuretic in cardiac dropsy; as a diet in consumption and other wasting diseases. In pharmacy for triturations, powders, etc., for diluent, as it is much harder than cane-sugar, hence aids in comminuting medicines more finely; it is less sweet than cane-sugar, and not so apt to ferment in the stomach or bowels, hence suitable for infant foods, certain forms of dyspepsia, etc.

Related Products:

1. Gelatinum. Gelatin, *official.*—(Syn., Gelat.; Fr. Gélatine; Ger. Gelatina alba, Weisser Leim.) The purified product obtained from animal tissues, as skins, ligaments and bones, by treatment with boiling water.

Manufacture: Gelatinous tissues, as skins, tendons, ligaments, bone-cartilage, bones, hoofs, horns, etc., previously cleansed by washing in cold water, or treatment with dilute alkali solution, are placed on a perforated diaphragm in a boiler, and boiled with water until the collagen becomes soluble, and solution stiffens to a jelly on cooling; while hot solution is deprived of fat, extraneous matter and impurities by skimming, straining, etc.; when cold jelly is cut into cakes, which are dried on nettings. It is an amorphous solid, in sheets, flakes, ground, powdered, shredded, colorless, slightly yellowish, slight characteristic odor and taste; unalterable in the air when dry, decomposing when moist or in solution; insoluble in cold water, but swells and softens in it, absorbing 5–10 times its own weight; soluble in hot water, acetic acid, glycerin; insoluble in alcohol, chloroform, ether, benzene, carbon disulphide, fixed or volatile oils. *Tests:* 1. Aqueous solution (1 in 5,000), + tannic acid T. S.—at once turbid. 2. Hot aqueous solution (1 in 40) is without putrid odor, not more than slightly acid or opalescent in a stratum of 2 Cm. ($\frac{4}{5}'$) thickness, and on cooling and standing forms a firm transparent or translucent jelly; incinerate .5 Gm.—ash 2 p. c., which dissolved in hot distilled water 25 Ml. (Cc.) + few drops of hydrochloric acid—does not respond to heavy metals. *Impurities:* Heavy metals, arsenic, sulphur dioxide (that used in capsules containing not more than .15 p. c.).

PREPARATION.—1. *Gelatinum Glycerinatum.* Glycerinated Gelatin. (Syn., Gelat. Glycerin., Glycerin Jelly; Fr. Gelée Glycerinée; Ger. Glycerinleim.)

Manufacture: Cover over gelatin 100 Gm. with water, previously boiled and cooled, let stand 1 hour, discard water, drain and heat gelatin with glycerin 100 Gm., on water-bath until dissolved, strain and continue heat until product weighs 200 Gm.; when cold cut into pieces, preserve in well-closed containers.

PROPERTIES AND USES.—Hæmostatic, aneurism, increases coagulability of the blood, when unable to control by pressure or ligature; acts locally and generally in aiding blood coagulation; may be applied to oozing capillaries in 10 p. c. solution, or internally by hypodermic injection, in 1–2 p. c., mixed with normal salt solution (.9 p. c.); care must always be used to avoid veins and to have the solution sterilized, thereby preventing embolus, infection, tetanus, etc.

2. *Keratin, Ceratin.*—Resembles protein, but has some of its oxygen replaced by sulphur, being the chief constituent of cattle and horses' hoofs, feather quills, finger-nails, and epidermal surface. Obtained by macerating horny substances 36 hours in pepsin (1), diluted hydrochloric acid (15), water (1,000), to remove all matter soluble in gastric juice, digest at moderate heat the residue in 10 times its weight of 5 p. c. ammonia water until nearly dissolved, filter, evaporate. Occurs in thick scales, yellowish-gray, opaque, soluble in alkalies and strong acetic acid, insoluble in water, alcohol, ether, diluted acetic acid, and acidified pepsin solutions. Used in coating pills—such as are not intended to dissolve in the stomach, but in the duodenum—where concentrated drugs are desired for the intestines, or the use of those incompatible with pepsin and decomposed by stomach's secretions —metallic sulphides, tannin, pancreatin, etc.

3. Serum Antidiphthericum. Antidiphtheric Serum, *official.*—(Syn., Ser. Antidiph., Diphtheria Antitoxin; Fr. Serum antidiphtérique; Ger. Diphtherie-Heilserum.)

Manufacture: A fluid, having a potency of 250 antitoxic units per Ml. (Cc.), separated from the coagulated blood of the horse, *E'quus* *cabal'lus*, or other large domestic animal, which has been immunized properly against diphtheria toxin. It is a yellowish, yellowish-brown, transparent or slightly turbid liquid, with sometimes a slight granular deposit; nearly odorless, or odor of antiseptic employed as a preservative, gradually loses potency, in one year 10–30 p. c. Must come from healthy animals, be sterile, free from toxins or other bacterial products, not contain excess of preservative (.5 p. c. of phenol or cresol, when either used), and not more than 20 p. c. of total solids.

Commercial.—The diphtheria bacillus when developing in the body causes the formation of toxins, albumoses, an organic acid, and a substance called antitoxin, which is present in the blood. Frequently the inherent quantity of antitoxin is sufficient to antagonize thoroughly the toxin produced, thereby insuring life; on the other hand, additional antitoxin may have to be introduced in order to save the patient. A culture of diphtheria bacilli may be grown on meat broth in a flask, to which have been added .5 p. c. of sodium chloride and 2 p. c. of peptone. After several weeks the bacilli are filtered off, when the remaining fluid should contain considerable diphtheria toxin of sufficient strength that ♏iss (.1 Ml. (Cc.)) will kill a guinea-pig. Now of this ♏iij–15 (.2–1 Ml. (Cc.)) are injected into a vein of a healthy young horse, which produce only slight symptoms; these having disappeared, a larger dose is administered to be followed with diphtheritic disturbances, and increasing doses repeated until ℥iij (90 Ml. (Cc.)) are given at each injection with little or no effect, thereby insuring a large amount of antitoxin in the blood serum. After several months 1 gallon (4 L.) of blood is withdrawn from the jugular vein of the horse into a sterilized vessel, allowed to coagulate, and the antitoxin serum placed in sterilized bottles, with some antiseptic (.5 p. c. phenol or cresol), and hermetically sealed. Can only be prepared in establishments licensed by the Secretary of the Treasury, United States, and each container must bear upon the label its name and number, also manufacturer's name, address, license number, date beyond which product is likely to be unreliable, and total number of antitoxic units claimed. Should be kept dark, in sealed glass containers, at 4.5–15° C. (40–59° F.), and not sold or dispensed when of lower potency than 250 units per Ml. (Cc.). Dose, hypodermic, 10,000 units; protective, 1,000 units.

Preparations.—1. *Serum Antidiphthericum Purificatum.* Purified Antidiphtheric Serum.—(Syn., Ser. Antidiph. Purif., Antidiphtheric Globulins, Concentrated Diphtheria Antitoxin, Diphtheric Antitoxin Globulins, Refined and Concentrated Diphtheria Antitoxin, Solution of Antitoxic Globulins.)

Manufacture: Separate from the serum or plasma of the immunized animal the antitoxin bearing globulins (by adding ammonium sulphate), dissolve in water, add sodium chloride sufficient to make a .6–.9 p. c. solution of the salt. It is a transparent, slightly opalescent liquid, sometimes with slight granular or ropy deposit, or more or less viscous; nearly odorless, or odor of antiseptic employed as a preservative (.5 p. c. of phenol or cresol, when either used); total solids must not exceed 20 p. c., must have the potency of 250 units per Ml. (Cc.); must conform to all requirements of antidiphtheric serum, and be kept with same precautions. Dose, hypodermic, 10,000 units; protective, 1,000 units.

2. *Serum Antidiphthericum Siccum.* Dried Antidiphtheric Serum.—(Syn., Ser. Antidiph. Sicc., Dried Diphtheria Antitoxin.)

Manufacture: Evaporate either of the preceding liquid serums in a vacuum, over sulphuric acid or other desiccating agent, or pass over it a current of warm air freed from bacteria, when it has the potency of 4,000 units per Gm. It is in orange-yellowish flakes, small lumps, yellowish-white powder; odorless, soluble in water (9), solution being opalescent and slightly viscous. For use—dissolve serum immediately beforehand in recently boiled and cooled distilled water—9 (?) preferably in the original container, under most rigid aseptic conditions, when it has the potency of 250 antitoxic units per Ml. (Cc.). Must conform to all requirements of antidiphtheric serum, be kept dark, in hermetically sealed, amber-colored glass containers free from air, at 4.5–15° C. (40–59° F.); does not lose in potency, as does the liquid serum. Dose, hypodermic, 10,000 units; protective, 1,000 units.

Properties and Uses.—Diphtheria and immunity therefrom. The serum should always be injected with a specially devised syringe, preferably between the shoulders or on the side of the abdomen, the skin having been washed with an antiseptic prior to the injection. It is advisable to use small doses of concentrated, rather than large doses of diluted serum, and within the first 24 hours the patient should receive 2,000–4,000 normal units, divided into two or three doses, and each day thereafter the same quantity until improvement is manifest. The earlier the treatment the more certain the cure; erythematous rash, painful and swollen joints, fluctuations in temperature, etc., may follow several weeks after its use; large doses are not poisonous, and produce least distention of the tissues.

4. **Serum Antitetanicum. Antitetanic Serum,** *official*.—(Syn., Ser. Antitetan., Tetanus Antitoxin; Fr. Serum antitetanique; Ger. Tetanus-Heilserum.)

Manufacture: A fluid, having a potency of 100 units per Ml. (Cc.), separated from the coagulated blood of the horse, *Equus caballus*, or other large domestic animal, which has been immunized properly against tetanus toxin. It is a yellowish, yellowish-brown, transparent or slightly turbid liquid, sometimes with a slight granular deposit; nearly odorless, or odor of antiseptic employed as a preservative; gradually loses its potency, especially at high temperatures. Must come from healthy animals, be sterile, free from toxins or other bacterial products, not contain excess of preservative (.5 p. c. of phenol or cresol, when either used), and not more than 20 p. c. of total solids.

Commercial.—The tetanus toxins are most virulent poisons and their antitoxin, the first discovered, has the same physical and chemical properties as that of diphtheria. The serum is produced precisely as the antidiphtheric serum, using, however, for the repeated injections into the vein of a healthy young horse cultures of the tetanus bacillus. Can only be prepared in establishments licensed by the Secretary of the Treasury, United States, and each container must bear upon the label its name and number, also manufacturer's name, address, license number, date beyond which product is likely to be unreliable, and total number of antitoxic units claimed. The standard of strength, expressed in units of antitoxic power, shall be that established by the United States Public Health Service. It should be kept dark, in sealed glass containers, at 4.5–15° C. (40–59° F.). Dose, hypodermic, 10,000 units; protective, 1,500 units.

Preparations.—1. *Serum Antitetanicum Purificatum.* Purified Antitetanic Serum.—(Syn., Ser. Antitetan. Purif., Antitetanic Globulins, Concentrated Tetanus Antitoxin, Refined and Concentrated Tetanus Antitoxin, Solution of Antitoxic Globulins, Tetanus Antitoxin Globulins.)

Manufacture: Separate from the serum or plasma of the immunized animal the antitoxin-bearing globulins (proteins—by adding ammonium sulphate), dissolve in water, add sodium chloride sufficient to make a .6–.9 p. c. solution of the salt. It is a transparent, slightly opalescent liquid, sometimes with slight granular or ropy deposit, or more or less viscous; nearly odorless, or odor of antiseptic employed as a preservative (.5 p. c. of phenol or cresol, when either used); total solids must not exceed 20 p. c., must have potency of 100 units per Ml. (Cc.); must conform to all requirements of antitetanic serum and be kept with same precautions. Dose, hypodermic, 10,000 units; protective, 1,500 units.

2. *Serum Antitetanicum Siccum.* Dried Antitetanic Serum.—(Syn., Ser. Antitetan. Sicc., Dried Tetanus Antitoxin.)

Manufacture: Evaporate either of the preceding liquid serums in a vacuum, over sulphuric acid, or other desiccating agent, or pass over it a current of warm air freed from bacteria, when it has a potency of 1,000 units per Gm. It is in orange-yellowish flakes, small lumps, yellowish-white powder; odorless, soluble in distilled water (9), solution being opalescent and slightly viscous. For use—dissolve serum in recently boiled and cooled distilled water (—9), preferably in the original container, under most rigid aseptic conditions and use immediately. Must conform to all requirements of antitetanic serum, and be kept dark, in hermetically sealed amber-colored glass containers, free from air, at 4.5–15° C. (40–59° F.); does not lose in potency as does the liquid serum. Dose, hypodermic, 10,000 units; protective, 1,500 units.

Properties and Uses.—Tetanus (tonic spasm of some or all of the voluntary muscles, when confined to lower jaw, usually part first affected—lockjaw, trismus), an infection as a rule through a wound, when it is well to enlarge incision sufficient to remove any foreign substance, thereby employing good surgery as well as abundant serum; ʒiiss (10 Ml. (Cc.)), every 6 hours for several days, unless symptoms improve. May trephine skull and inject into brain direct

♏xv–45 (1–3 Ml. (Cc.)), but action uncertain. Best as a prophylactic, as soon as possible after the infection; sometimes used as a dusting powder locally.

5. **Virus Vaccinicum. Vaccine Virus,** *official.*—(Syn., Virus Vaccin., Glycerinated Vaccine Virus, Smallpox Vaccine, Jennerian Vaccine; Fr. Vaccin; Ger. Impfstoff.)

Manufacture: The pustules (pulp, dried scab) of vaccinia or cowpox from vaccinated animals (calves) of the bovine species, wherein the pulp is powdered, rubbed, or ground, sifted or strained to remove coarse particles, and made into a smooth emulsion with a glycerin solution, which has a certain antiseptic action. Gradually loses potency, especially at high temperature, and usually after 3 months is of little value.

Commercial.—The ravages of smallpox in civilized communities, prior to Jenner's discovery, May 14, 1796, often included one-tenth of the entire population. It had been observed that dairymaids who contracted cowpox were immune from smallpox, and, after twenty years of close observation and study of the subject, Jenner on the above date vaccinated a boy with a cowpox scab taken from the hand of his father's milkmaid, and after a few weeks' intermission inoculated the same boy with smallpox virus without producing, however, the slightest symptoms of that disease, a fact which, upon further verification by him, lead immediately to the establishment of his belief and claim. Owing to blood taints and lurking disease human virus no longer is employed, but only that coming from healthy bovine animals (calves 2–3 years old), those having no communicable malady, or even suspected of it, other than vaccinia; each animal must be under veterinary examination for 7 days prior to vaccination, and as soon as the vaccine pulp is removed a necropsy must be made and permanent records kept. Each lot of virus must be examined to insure freedom from pathogenic micro-organisms, tetanus spores or toxin, the records of the same being preserved on file, and must be marketed in sterile containers bearing upon the label its name and number, also name, address, and license number of the manufacturer under permit of the Secretary of the Treasury, United States, as well as the date beyond which the product is likely to be unreliable. It should be kept dark, at a temperature of 4.5–15° C. (40–59° F.). Some manufacturers use the serum, exuding after removal of the crusts, for preparing the "dry lymph points," but these are regarded generally as unsatisfactory.

6. **Hypophysis Sicca. Desiccated Hypophysis,** *official.*—(Syn., Hypophysis Sic., Desiccated Pituitary Body; Ger. Trockene Hypophysis.) The posterior lobe obtained from the pituitary body (gland—at base of brain; anterior lobe larger, dissimilar action) of cattle, cleaned, dried, and powdered. It is a yellowish, grayish, amorphous powder, characteristic odor, partially soluble in water. Dose, gr. $\frac{1}{2}$–4 (.03–.2 Gm.).

Preparation.—1. *Liquor Hypophysis.* Solution of Hypophysis. (Syn., Liq. Hypophysis, Solution of the Pituitary Body; Ger. Hypophysislösung.)

Manufacture: Extract the finely minced material with slightly acidulated water, boil solution 10 minutes, sterilize filtrate and preserve it in a sterile condition in glass containers. It is a transparent aqueous solution, colorless or nearly so, faint characteristic odor; contains the water-soluble principle or principles from the fresh posterior lobe. Dose, ♏x–30 (.6–2 Ml. (Cc.)).

Properties and Uses.—Cardiac stimulant (slows and strengthens heart action), diuretic, dilating renal vessels, increasing urine.

7. *Streptococcus Antitoxin.*—This serum is prepared similarly to the preceding, using, however, several rabbits, as well, finally, as the horse, for increasing the virulence, and not bleeding the latter until a year after the first inoculation. These streptococci produce the severe forms of septicæmia following the puerperium, after injuries and operations, in erysipelas, scarlet fever, etc. Dose, ʒiiss–5 (10–20 Ml. (Cc.)).

8. *Lac Vaccinum, Cow's Milk.*—The secretion by the cow's mammary glands; white, opaque liquid (emulsion) of minute fat globules suspended in solution of casein, albumin, milk-sugar and inorganic salts, pleasant taste, slight odor; upon standing few hours the oily globules (cream) owing to lightness separate to the surface; each is surrounded by an albuminous envelope which may be dissolved by an alkali, thus liberating and permitting aggregation into butter; contains water 87 p. c., solids 13 p. c.—milk-sugar 4 p. c., butter 4 p. c., casein 4.4 p. c., salts (chiefly phosphates) .6 p. c. By churning the fat globules unite to form butter, leaving a liquid called *buttermilk*—solution of milk-sugar, salts, some casein and butter; skimmed milk develops lactic acid and separates the casein as a coagulum—*curd,* either upon standing (through action of a certain bacterium), or the addition of other acids, or rennet (rennin—prepared from inner membrane of calf's stomach); the liquid separated from the coagulum is *whey,* which contains milk-sugar and salts; the coagulum upon the addition of salt and proper manipulation gives *cheese.* Human milk is always alkaline, that of cow's either alkaline or acid. *Humanized Milk* may be prepared by mixing: cream ℥j (30 Ml. (Cc.)), cow's milk ʒiv (15 Ml. (Cc.)), lime water ℥j (30 Ml. (Cc.)), water ℥iss (45 Ml. (Cc.)), milk-sugar gr. 30 (2 Gm.). *Condensed Milk* is prepared by evaporating milk to the consistence of thick cream (one-fourth its bulk), usually adding sugar for preservation and transportation. *Fermented Milk, Lac Fermentatum* (Kumyss, Koumyss, Kefir, Matzoon)—obtained by adding to cow's milk (mare's formerly) either kefir ferment or yeast. Mix fresh milk 4 pints (2,000 Ml. (Cc.)), sugar 2¼ ounces (70 Gm.), Fleischmann's compressed yeast 96 grains (6 Gm.), introduce into strong bottles within an inch of the neck, close securely, keep at 23–32° C. (73–90° F.) 6 hours, transfer to cold place. It is a cream-like liquid, strongly frothing, pleasant acid taste, containing casein, alcohol, lactic acid, carbon dioxide, fat, lactose, albumin, hemialbumose, peptone—these varying somewhat according to length of fermentation, alcohol and carbon dioxide increasing continuously. Dose, ℥viij (240 Ml. (Cc.)).

Properties and Uses.—More readily digested and absorbed than milk; quenches thirst, relieves hunger, stimulates circulatory, nervous, and respiratory systems, increases nutrition, urine, perspiration; indigestion due to either depression or stomach irritability, enteric fever, typhoid state, secondary anæmias, chronic constitutional diseases.

9. *Butyrum, Butter.*—This is obtained by churning the cream rising to the surface of cow's milk. It is soft, yellow, neutral (if acid, due to free butyric acid), sp. gr. 0.930, melts at 32° C. (89.6° F.), congeals at 23° C. (73° F.); odor delicate, sweet; taste bland; contains olein 30 p. c., palmitin and stearin 68 p. c., about 2 p. c. glycerides of butyric, capronic, caprylic, and caprinic acids. When employed in medicine, should be freed from salt and casein by melting it in warm water and decanting the clear liquid. If 100 parts be saponified by alkali, and the soap decomposed by hydrochloric acid, get fat acids, which, after washing (to remove 8 p. c. volatile fat acids) and drying, weighs 85–88 parts; other fats yield about 95 p. c. of fat acids insoluble in water. Used as demulcent, lenitive, ointment, dietetic.

10. *Extractum Carnis, Extract of Beef (Meat).*—The residue obtained from fresh beef broth by evaporation at a low temperature—grind lean beef to a pulpy mass, stir with equal quantity of water; strain, evaporate in steam-pans over which a current of air is passed continuously, filter, evaporate to desired consistence; less nutritious than meat, as fat, albumin, much fibrin and gelatin are removed.

11. *Oleum Bubulum, Neat's-foot Oil.*—Obtained by boiling in water the fatty tissue of the feet of the ox, deprived of hoofs, skimming oil from the surface, keeping it some time on warm water for impurities to settle; it is yellowish, peculiar odor; used for softening leather, etc.; for cod liver oil, but occasions diarrhœa.

12. *Sanguis, Blood.*—This, the arterial fluid of the ox, is red, opaque, peculiar odor, sp. gr. 1.050; consists of blood corpuscles in suspension; coagulates on exposure, separating the clot (cruor) from the liquid (serum); contains water 78 p. c., albumin 7 p. c., fibrin .4 p. c., corpuscles, hæmoglobin, etc., 13 p. c., salts .9 p. c.—alkalies, calcium and magnesium chlorides, phosphates, sulphates; the serum contains 10 p. c. solids—8 p. c. of which are albuminoids. When evaporated have extractum or pulvis sanguinis. Used as restorative. Dose, gr. 5–15 (.3–1 Gm.).

13. *Os, Bone.*—The skeleton of vertebrate animals, official 1850–1880. Bone has a solid, white, smooth, lamellated texture, internally porous, consisting of a cellular gelatinous tissue filled with calcareous deposits (earthy salts). It is insoluble in water, soluble in hydrochloric acid with effervescence, leaving behind a gelatinous mass (ossein); contains calcium phosphate 40–67 p. c., calcium carbonate 5–10 p. c., magnesium phosphate 1–2 p. c., calcium fluoride 1 p. c., traces of Si, Fe, Mn, NaCl. Ossein yields gelatin when boiled with water; when dry distilled get Dippel's animal oil, containing pyridine, picoline, and other bases. Used for preparing animal charcoal (bone-black), phosphates, superphosphates (manure).

RECAPITULATION NO. 8.

Class and family. 1. Latin official name. 2. Eng. official name.	Zoölogic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
Class *Insecta.* Family *Hemiptera.* 1. Coccus. 2. Cochineal.	Coccus cacti.	The dried female insect.	Mexico, C. America.	Carminic acid, coccerin, fixed oil, vol. oil.	Tinct. card. comp.	Stimulant, diuretic, antispasmodic.	Whooping-cough, neuralgia, for coloring preparations.	Grains. 1–15 (.06–1 Gm.).
Class *Insecta.* Family *Coleoptera.* 1. Cantharis. 2. Cantharides.	Cantharis vesicatoria.	The dried beetle.	S. and C. Europe, W. Asia.	Cantharidin, fat, odorous compound, extractive, salts.	Cerate, collodion canth., tincture.	Diuretic, aphrodisiac, emmenagogue, rubefacient, acrid poison.	Dropsy, bronchitis, bladder debility, gleet, diabetes, amenorrhœa, ulcers, brain congestion, pleurisy, dysmenorrhœa, rheumatism, tetanus, apoplexy, meningitis.	⅙–1 (.01–.06 Gm.).
Class *Insecta.* Family *Hymenoptera.* 1. Mel. 2. Honey.	Apis mellifera.	A saccharine secretion.	N. America, Europe.	Grape-sugar, wax, vol. oil, proteids, mucilage, formic acid, coloring.	Clarified honey, mel rosæ, Hg. cum Cret., mass Fe carb.	Demulcent, laxative, stimulant, nutritive.	Aphthæ, thrush, boils, fissures.	Ad libitum.
1. Cera Flava. 2. Yellow Wax.		A solid substance from the honeycomb.	....	Hydrocarbons, cerin, myricin.	Canthar. cerate, rosin cerate, rosin plast., ointment of tar, white wax: cerate, oint., ung. aq. ros.	Protective, demulcent, emollient.	Plasters, cerates, ointments, diarrhœa, neuralgia, gleet, protective.	Externally.
Class *Pisces.* Family *Teleostia.* 1. Oleum Morrhuæ. 2. Cod Liver Oil.	Gadus Morrhua, +.	A fixed oil.	N. Atlantic Ocean.	Olein, palmitin, stearin, iodine, aselline, morrhuine, chlorine, bromine, phosphorus.	Emulsion.	Alterative, demulcent, nutrient.	Wasting diseases, phthisis, bronchitis, rheumatism, skin affections, nerve tonic, scrofula, arthritis (gout).	Minims. ʒj–4 (4–15 Ml. (Cc.)).
Class *Mammalia.* Family *Cetacea.* 1. Cetaceum. 2. Spermaceti.	Physeter macrocephalus.	A concrete fatty substance.	Pacific and Indian Oceans.	Cetylic alcohol combined with palmitic acid.	Ung. aq. ros.	Lenitive, demulcent. emollient.	Base of cerates, ointments, etc., urinary irritation.	Externally.
Class *Mammalia.* Family *Pachydermata.* 1. Adeps. 2. Lard.	Sus scrofa var. domesticus.	The purified internal fat.	....	Olein, palmitin, stearin.	Benz. lard, cerate, ointment.	Emollient—in poultices, etc.	To protect surfaces.	
1. Pancreatinum. 2. Pancreatin.		Mixture of enzymes.	Universal.	....	....	Ferment.	Dyspepsia, indigestion.	Grains. 5–15 (.3–1 Gm.).
1. Pepsinum. 2. Pepsin.		Mixture containing enzyme.	....	....	....	Ferment.	Dyspepsia, indigestion, diarrhœa.	5–30 (.3–2 Gm.).

Recapitulation No. 8—*Continued.*

Class and family. 1. Latin official name. 2. Eng. official name.	Zoölogic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
Class *Mammalia.* Family *Ruminantia.* 1. Moschus. 2. Musk.	Moschus moschiferus.	The dried secretion from the preputial follicles.	C. Asia.	Vol. oil, ammonia, acid, fat, cholesterin, gelatinous and albuminous principles.	Tincture.	Antispasmodic, nervine, anodyne, stimulant, aphrodisiac.	Typhoid, pneumonia, convulsions, hiccough, croup, whooping-cough nausea, colic, hysterics, tetanus, rheumatism, sprains.	1–10 (.06–.6 Gm.).
1. Sevum Præparatum. 2. Prepared Suet.	Ovis aries.	The internal fat.	....	Stearin, palmitin, olein, hircin.	Ointment of mercury.	Lenitive.	Dressing blisters, excoriated surfaces, chapped hands.	Externally.
1. Adeps Lanæ. 2. Wool Fat.		The purified fat of the wool.	....	Cholesterin, ethers of stearic, palmitic, oleic, valeric acids.	Hydrous wool fat, plasters, ointments.			
1. Suprarenalum Siccum. 2. DriedSuprarenals.		Suprarenal glands.	Universal.	Epinephrine (adrenalin, etc.).	....	Astringent, hæmostatic, cardiac stim., local anæsthetic.	Rhinitis, hay fever, conjunctivitis, iritis, epistaxis, goitre, diabetes.	Grains. (3–15 (.2–1 Gm.).
1. Thyroideum Siccum. 2. Dried Thyroids.		Thyroid glands.		....	....	Circulatory sedative (depressant).	Dementia, goitre, reduce weight.	5–10 (.3–.6 Gm.).
1. Fel Bovis. 2. Oxgall.	Bos taurus.	The fresh bile.	Universal.	Bilirubin, cholesterin, lecithin, cholic and choleic acids, mucilage.	Purified oxgall.	Tonic, laxative, cholagogue, antiseptic, vermifuge.	Constipation, dyspepsia, jaundice, glandular enlargements.	Grains. 5–15 (.3–1 Gm.).
1. SaccharumLactis. 2. Sugar of Milk.		Lactose.		$C_{12}H_{22}O_{11} + H_2O$.	Pulv. ip. et. opii, triturates (elaterin, etc.).	Diuretic, diluent.	Cardiac dropsy, wasting diseases, consumption.	480–2400 (30–150 Gm.).
1. Virus Vaccinicum. 2. Vaccine Virus.		Vaccinia pustules.		....	....	Prophylactic.	Smallpox.	
1. Hypophysis Sicca. 2. Desiccated Hypophysis.		Pituitary body.		....	Liquor.	Cardiac stimulant, diuretic.	Dilates renal vessels, increases urine.	
1. Serum Antidiphthericum. 2. Antidiphtheric Serum.	Equus caballus.	Blood serum.	Universal.	Antitoxin.	Purified, dried.	Antogonist, poisonous.	Diphtheria.	2,000–4,000 normal units.
1. Serum Antitetanicum. 2. AntitetanicSerum.	....	....	....	....	Purified, dried.	....	Tetanus.	1,500–10,000 units.

PART III.

INORGANIC DRUGS FROM THE MINERAL KINGDOM.

I. METALLOIDS AND THEIR COMPOUNDS.

HYDROGEN.

$H^{i} = 1.$

THE element hydrogen (Gr. ὕδωρ, water, + γενής, producing, generates water—*i. e.*, upon combustion, becoming one of its components) is not official, although in combination, especially with oxygen, forms most important compounds. It is found chiefly in water, animal and vegetable substances, all acids, and in the free state in gases from decomposing organic matters, intestines, and interior of the earth; it is combustible (blue flame) with intense heat, has great affinity for oxygen, often combining to form hydrates with dangerous reports and results.

Aqua. Water, H_2O.—(Syn., Hydrogen Monoxide; Fr. Eau; Ger. Aqua communis, Wasser.)

Potable water in its purest attainable state. By this the U. S. P. means any water—be it rain (*aqua pluvialis*), snow (*aqua nivalis*), spring (*aqua fontana*), river (*aqua fluvialis*), or lake (*aqua lacalis*)—suitable for drinking, which does not curdle soap, or contain copper, iron, lead, ammonium compounds, chlorides, nitrates, nitrites, organic substances, solids. It is a colorless, neutral, limpid liquid, practically tasteless and odorless; heated near boiling and agitated—evolves no disagreeable odor. *Impurities:* Iron, lead, copper, chloride, nitrite, nitrate, solids, ammonium compounds, organic substances.

PREPARATIONS.—1. *Aqua Destillata.* Distilled Water, H_2O. (Syn., Aq. Dest.; Fr. Eau distillée, Hydrolat simple; Ger. Destilliertes Wasser.)

Manufacture: Distil water 1,000 vol., reject first 100 vol., collect the next 750 vol. The first portion is liable to contain volatile substances, the last solid and organic matter, hence both are rejected. It is colorless, neutral, limpid liquid, odorless, tasteless. *Impurities:* Heavy metals, calcium chloride, sulphate, ammonia, carbon dioxide, organic or other oxidizable substances. Should be kept in glass-stoppered bottles, having been rinsed with hot distilled water just prior to filling.

2. *Aqua Destillata Sterilisata.* Sterilized Distilled Water, H_2O. (Syn., Aq. Dest. Steril; Ger. Sterilisirtes Destilliertes Wasser.)

Manufacture: Transfer necessary quantity of freshly distilled water to a cleansed, sterilized hard-glass flask, close mouth with pledget of sterilized purified cotton, boil 30 minutes, cool without removing plug, protect mouth and cotton pledget from infection through dust by wrapping the top tightly with paper; should be used within 48 hours after preparation.

The purer water is the softer; hard water curdles soap from presence of calcium (sulphate, carbonate) or magnesium salts, consequently it is poorly adapted for domestic use.

PROPERTIES.—Demulcent, diuretic, diaphoretic, solvent, diluent.

Vapor bath accelerates circulation, causes profuse sweating.

Hot bath stimulates, producing redness of face and skin.

Warm bath slows respiration, reduces body temperature, relaxes skin, causes sleep. Valuable in febrile exanthematous diseases.

Cold bath abstracts heat, sometimes stimulant, tonic, sedative. Popular and very useful in febrile conditions, especially typhoid.

MINERAL WATERS.—In addition to the three preceding official waters a number of natural waters are used medicinally, which contain one or more chemicals, being named according to some active ingredient or therapeutic value. Thus we have:

Alkaline waters, containing $NaHCO_3$ (usually predominates), $NaCl$, Na_2SO_4, and often free CO_2—Vichy, Kissingen, Carlsbad, Ems, Saratoga.

Chalybeate waters, containing $FeSO_4$, Fe_2CO_3—Wiesbaden, Brighton, Spa, Bedford, Rockbridge Alum.

Hepatic or sulphur waters, containing H_2S—Aix-la-Chapelle, White Sulphur, Blue Lick, Sharon, Richfield.

Bitter waters, containing $MgSO_4$, $MgCl_2$—Hunyadi, Friedrichshall.

Carbonated waters, containing Ca, Mg, Fe—carbonates held in solution by CO_2—Seltzer, Apollinaris, Old Sweet, White Rock, etc.

Lithia waters, containing lithium salts—Buffalo, Londonderry, Magnetic.

The list of such springs is lengthy, and all are asserted to be specific for one or more ailments. To obtain the benefit claimed, it is always best to visit the spring itself, and there, free from cares, worries, etc., drink the waters under the directions of a resident physician.

Liquor Hydrogenii Dioxidi. Solution of Hydrogen Dioxide, H_2O_2.—(Syn., Liq. Hydrog. Diox., Aqua Hydrogenii Dioxidi, U. S. P. 1900, Solution of Hydrogen Peroxide, Oxygenized Water, Oxygen Hydrate; Br. Liquor Hydrogenii Peroxidi; Fr. Soluté de Peroxide d'Hydrogen; Ger. Wasserstoffsuperoxydlösung.)

Manufacture: Dissolve or hydrate to a magma, by shaking vigorously, barium dioxide 300 Gm. in cold distilled water 500 Ml. (Cc.), keep at 10° C. (50° F.), shake now and then vigorously, until fully hydrated; mix phosphoric acid 96 Ml. (Cc.) with distilled water 320

Ml. (Cc.), reserve 50 Ml. (Cc.), and to the remainder add the hydrated magma, shaking, cooling, and acidifying with the reserve occasionally, wash precipitate (barium phosphate) with distilled water q. s. 1,000 Ml. (Cc.); after filtration (aided by a little starch) add 30 drops of diluted sulphuric acid—until it ceases to produce cloudiness; mix cloudy liquid with starch 10 Gm., agitate, filter, assay, adjust to official strength—$BaO_2 + 2H_3PO_4 = Ba(H_2PO_4)_2 + H_2O_2$. It is a colorless aqueous liquid, odorless, or odor of ozone, slightly acid taste and reaction, producing a peculiar sensation and froth in the mouth; deteriorates on keeping or prolonged agitation; rapidly decomposed by many oxidizing and reducing substances; substituting a stopper coated with paraffin or a pledget of purified cotton, retards deterioration; contains 3 p. c. by weight of dioxide, H_2O_2, corresponding 10 volumes of available oxygen. *Tests:* 1. Expose to air at ordinary temperature, or heat on water-bath at 60° C. (140° F.)—loses chiefly water; rapidly heated it frequently decomposes suddenly. 2. Shake 1 Ml. (Cc.) with 10 Ml. (Cc.) of distilled water containing 1 drop of diluted sulphuric acid, add ether 2 Ml. (Cc.), + a drop of potassium dichromate T. S.—aqueous layer blue color, which passes into the ethereal layer upon agitation. *Impurities:* Heavy metals, arsenic, barium, free acid, oxalic acid, hydrofluoric acid, non-volatile matter. Upon removing stopper from the bottle only slight pressure should be observed. Should be kept cool and dark. Dose, ʒj–3 (4–12 Ml. (Cc.)).

Properties.—Oxidizant, stimulant (nervous system), increases urine, antiseptic, decomposes pus, kills microbes, prevents fermentation.

Uses.—Diabetes, atonic dyspepsia, dyspnœa, epilepsy, low fevers, whooping-cough, asthma, phthisis, anæmia, chlorosis, pneumonia; locally, in mucous membrane inflammations, wounds, ulcers, ozæna, ophthalmia, gonorrhœa, leucorrhœa, chancres, otorrhœa, rhinitis, diphtheria, bronchitis, fetid breath, cystitis, spray, gargle. *Pyrozone* is claimed to be 50 p. c. When hydrogen dioxide is dissolved in glycerin instead of water, we have *glycozone.*

OXYGENIUM. OXYGEN.

$O^{ii} = 16.$

(Syn., Fr. Oxygène; Ger. Oxygen, Sauerstoff.)

The element oxygen (Gr. ὀξὺς, acid, sharp, + γενής, producing—*i. e.*, a generator of acids, once supposed a component of all acids) is official, being most widely distributed and abundant, excelling all others in quantity, as it constitutes 89 p. c., by weight, of the water, 20 p. c. of the atmosphere, 30–50 p. c. of the rocks, and 45 p. c. of the total weight of our earth, besides being in most animal and plant tissues; it occurs in the free state, also in combination, uniting with acid and basic substances to form oxides.

Manufacture: Heat together, at low red heat, potassium chlorate (4–5) and manganese dioxide (1), and pass the evolved gas (oxygen +)

through a wash-bottle containing an alkali—$5KClO_3 + MnO_2 = 3KClO_4 + 2KCl + MnO_2 + O_3$. It is a colorless, odorless, tasteless gas, supports combustion more readily than air, in it glowing wood bursting into flame, soluble in water (34), alcohol (3.6), non-inflammable, neutral reaction; contains 95 p. c., by volume, of O. *Impurities:* Carbon dioxide, halogens, acids, bases.

Properties and Uses.—In diseases of respiratory and circulatory systems where an imperfect supply reaches the tissues, thereby improving the condition of the blood, cyanosis from impaired respiration, disagreeable after-effects of ether, chloroform, dyspnœa from Bright's disease or diabetes, mechanical hindrance. For convenience usually it is compressed hydraulically at very low temperature (225 pounds—to $\frac{1}{15}$ its volume) in metal (steel) cylinders, to which a mouthpiece is attached for inhalation; it may be inhaled from a jet under the nostrils.

NITROGEN.

$N^{iii} = 14.$

The element nitrogen (Gr. *νίτρον*, L. *nitrum*, niter, + *γενής, γένος*, produced from or generator of) is of considerable importance in medicine, owing to its ready combination with hydrogen and oxygen, thus forming several useful official compounds.

Aqua Ammoniæ. Ammonia Water, NH_4OH.—(Syn., Aq. Ammon., Spirit of Hartshorn; Br. Liquor Ammoniæ, Spiritus Salis Ammoniaci Causticus, Ammonia Aqua Soluta; Fr. Ammoniaque liquide, Eau (Solution, Liqueur) d'Ammoniaque; Ger. Liquor Ammonii caustici, Ammoniakflüssigkeit, Salmiakgeist, Ätzammoniak.) An aqueous solution of ammonia, NH_3 containing 9.5–10.5 p. c., by weight, of gaseous ammonia.

Manufacture: Heat gradually ammonium chloride and calcium hydroxide mixed together, and pass the gas thus generated into water —$2NH_4Cl + Ca(OH)_2 = CaCl_2 + 2H_2O + 2NH_3$. It is a colorless transparent liquid, pungent characteristic odor, caustic, alkaline taste and reaction; sp. gr. 0.958. *Tests:* 1. Produces dense white fumes in the presence of hydrochloric acid. 2. Evaporate 25 Ml. (Cc.) to dryness—residue .005 Gm. *Impurities:* Heavy metals, oxidizable and empyreumatic substances. Should be kept cool in glass-stoppered bottles made of hard glass free from lead, and, deteriorating with age, must be tested frequently. Dose, ♏x–20 (.6–1.3 Ml. (Cc.)), well diluted.

Preparations.—1. *Linimentum Ammoniæ.* Ammonia Liniment. (Syn., Lin. Ammon., Volatile Liniment, Hartshorn Liniment; Fr. Liniment (Savon) ammoniacal (volatil); Ger. Flüchtiges Liniment, Flüchtige Salbe.)

Manufacture: 25 p. c. Agitate ammonia water 25 Ml. (Cc.) with sesame oil 75 Ml. (Cc.) until a uniform mixture; should not be dispensed unless reasonably fresh; used externally.

2. *Spiritus Ammoniæ Aromaticus.* Aromatic Spirit of Ammonia. (Syn., Sp. Ammon. Arom., Spiritus Ammoniæ Compositus, Spirit of Sal Volatile; Fr. Alcoolat ammoniacal aromatique; Ger. Aromatischer Ammoniakgeist.)

Manufacture: To ammonia water 9 Ml. (Cc.) add distilled water 14 Ml. (Cc.), then ammonium carbonate 3.4 Gm.; to alcohol 70 Ml. (Cc.) add oil of lemon 1 Ml. (Cc.), oil of lavender .1 Ml. (Cc.), oil of myristica .1 Ml. (Cc.), then the ammonium carbonate solution, and finally distilled water q. s. 100 Ml. (Cc.), set aside 24 hours, filter. It is a nearly colorless liquid when fresh, but gradually yellowish with age; pungent odor and taste of ammonia; sp. gr. 0.900. Should be kept cool, in glass-stoppered bottles. Dose, ♏x–60 (.6–4 Ml. (Cc.)), well diluted.

Preps.: 1. *Tinctura Guaiaci Ammoniata.* Guaiac 20 Gm., aromatic spirit of ammonia q. s. 100 Ml. (Cc.). 2. *Tinctura Valerianæ Ammoniata.* Valerian 20 Gm., aromatic spirit of ammonia q. s. 100 Ml. (Cc.).

Unoff. Preps.: Lotio Ammoniacalis Camphorata, 6 p. c., + spirit camphor 1, sodium chloride 6, water q. s. 100. *Spiritus Ammoniæ Anisatus,* 3 p. c. (anethol), ammonia water 20, alcohol q. s. 100.

PROPERTIES.—Stimulant, antacid, irritant, rubefacient, caustic, corrosive poison; before meals increases, but after neutralizes gastric juice.

USES.—Heartburn, nauseating headache, stimulates circulation and respiration, paralyzes the heart muscle. It is oxidized in the system, forming nitric acid, which is eliminated by kidneys; externally in rheumatism, neuralgia, congestion of larynx, throat, bowels, amenorrhœa, burns, frost-bite, vulvar pruritus, syncope, bronchitis, hoarseness, acidity, whooping-cough, stings (of bees, mosquitoes, spiders, wasps, etc.); antidote to chlorine, bromine, hydrocyanic acid, alcoholic intoxication. Mixed with oil should be applied by gentle friction.

Poisoning: Have burning pain from mouth to stomach; difficult deglutition, vomiting and purging of blood and mucus, cold and clammy skin, feeble pulse, collapse, sense of suffocation, convulsions, stupor, coma. Give vegetable acids (vinegar, lemon juice), oil, demulcents, stimulants (atropine, strychnine, digitalis, brandy, etc.), opium for the pain.

Synergists: Cardiac and diffusible stimulants, antispasmodics, capsicum, cantharides, counter-irritants.

Aqua Ammoniæ Fortior. Stronger Ammonia Water, NH_4OH.—(Syn., Aq. Ammon. Fort., Br. Liquor Ammoniæ Fortis; Fr. Eau d'Ammoniaque forte; Ger. Stärker Salmiakgeist.) An aqueous solution of ammonia (NH_3), containing 27–29 p. c., by weight, of gaseous ammonia.

Manufacture: Same as aqua ammoniæ, only much more ammonia (gas) is required to give the 27–29 p. c. saturation. It is a colorless, transparent liquid, excessively pungent characteristic odor, very caustic alkaline taste and reaction; sp. gr. 0.897; diluted with distilled water (2)—responds to tests for identity and purity of aqua ammoniæ. Should be kept cool in partly filled, strong glass-stoppered bottles made of hard glass free from lead, handled with great caution (never tasted unless greatly diluted), and, deteriorating with age, must be tested frequently. Dose, ♏iij–6 (.2–.4 Ml. (Cc.)), well diluted.

PREPARATION.—(Unoff.): *Spiritus Ammoniæ*, 10 p. c. (condensing gas in alcohol instead of water), dose, ♏x–30 (.6–2 Ml. (Cc.)), well diluted.

PROPERTIES AND USES.—Too strong for internal use unless largely diluted. Externally—rubefacient; should be mixed with spirit of camphor, oil of rosemary, etc., for rheumatism, neuralgia, spasmodic and inflammatory affections. Spirit is stimulant, antispasmodic; given in hysteria, flatulent colic, nervous debility, nauseating headache.

Nitrogenii Monoxidum. Nitrogen Monoxide, N_2O.—(Syn., Nitrogen Monox., Nitrous Oxide, Laughing Gas; Fr. Oxyde nitreux, Protoxyde d'azote; Ger. Stickstoffoxydul, Lachgas.)

Manufacture: Heat gradually pure ammonium nitrate (without chloride) to 200–240° C. (392–464° F.)—NH_4NO_3 + heat = $2H_2O + N_2O$—pass gas through solution of ferrous sulphate to remove nitric oxide, and solution of potassium hydroxide to neutralize acids and chlorine; higher temperature produces white fumes (nitrous oxide, nitrogen, ammonia), when heat should be reduced. It is a colorless gas, slight characteristic odor, sweetish taste, non-inflammable, supports combustion of many substances; by cold and pressure condensed into liquid, then into crystals, soluble in water (1 vol. dissolving 1.3 vols.), alcohol, volatile and fixed oils. *Impurities:* Carbon dioxide, halogens, acids, bases, reducing substances.

PROPERTIES AND USES.—Anæsthetic, stimulant, produces mental disturbances with hilarity, and as it raises arterial tension (pressure) should not be given to those having fatty heart or atheroma of the bloodvessels (producing apoplexy, heart failure); anæsthesia due to influence on central nervous system and asphyxiation. Chiefly in dentistry for extracting teeth, minor operations; major surgery to produce primary anæsthesia to be followed immediately by ether or chloroform. For convenience gas compressed in metal (steel) cylinders; safest anæsthetic, death-rate being only 1 in 500,000.

Acidum Nitricum. Nitric Acid, HNO_3.—(Syn., Acid. Nitric., Acidum Nitri (Azoticum), Spiritus Nitri Acidus, Spirit of Nitre, Aqua Fortis; Fr. Acide nitrique (azotique); Ger. Salpetersäure.) An aqueous solution containing 67–69 p. c. of HNO_3.

Manufacture: It is obtained by combining nitrogen pentoxide with water—$N_2O_5 + H_2O = 2HNO_3$; or by double decomposition between potassium nitrate or sodium nitrate and sulphuric acid, with heat—$NaNO_3 + H_2SO_4 = HNO_3 + NaHSO_4$, or $2NaNO_3 + H_2SO_4 = 2HNO_3 + Na_2SO_4$. It is a fuming, caustic, corrosive liquid; peculiar, suffocating odor; strongly acid taste and reaction, even if highly diluted; sp. gr. 1.403; volatile at 110° C. (230° F.); dissolves copper, mercury, silver, and other metals with brownish-red fumes; stains woolen fabrics and animal tissues bright yellow. *Tests:* 1. Evaporate 20 Ml. (Cc.) —residue .003 Gm. (abs. of non-volatile substances). 2. Shake with distilled water (3) + little chloroform—latter colorless (abs. of bromine, iodine), even after adding metallic tin (abs. of bromic, iodic acids). 3. With distilled water (10) + barium chloride T. S.—no precipitate (abs. of sulphuric acid); with silver nitrate T. S.—no precipitate (abs. of hydrochloric acid). *Impurities:* Heavy metals, arsenic, bromine, iodine, bromic, hydrochloric, iodic, sulphuric acids, non-volatile substances. Should be kept dark, in dark, amber-colored, glass-stoppered bottles. Dose, ♏ij–5 (.13–.3 Ml. (Cc.)), well diluted.

PREPARATIONS.—1. *Acidum Nitrohydrochloricum.* Nitrohydrochloric Acid. (Syn., Acid. Nitrohydrochl., Nitromuriatic Acid, Aqua Regia (Regis); Fr. Acide Chloro(azotique)-nitreux, Eau régale; Ger. Acidum Chloro-nitrosum, Saltpetersalzsäure, Königswasser.)

Manufacture: Mix in capacious glass vessel nitric acid 18 Ml. (Cc.), hydrochloric acid 82 Ml. (Cc.); allow effervescence to cease. The two acids act chemically upon each other, forming a strong aqueous solution containing hydrochloric, nitric acids, nitrosyl chloride, chlorine, the latter in a free state aiding greatly the dissolving power — $HNO_3 + 3HCl = H_2O + NOCl + Cl_2$; the nitrosyl chloride, NOCl, is a yellowish gas, becoming red at —5° C. (23° F.). It is a golden-yellow, fuming, corrosive liquid; strong chlorine odor; intensely acid taste and reaction, bleaching litmus; readily dissolves gold leaf; evaporate 10 Ml. (Cc.)—residue .0035 Gm.; contains 38.5 p. c. of absolute acid. Should only be dispensed when 1 drop added to 1 Ml. (Cc.) of aqueous solution of potassium iodide immediately liberates iodine, and should be kept cool, in half-filled, glass-stoppered, dark amber-colored bottles. Dose, ♏ij–5 (.13–.3 Ml. (Cc.)), well diluted.

Prep.: 1. *Acidum Nitrohydrochloricum Dilutum.* Diluted Nitrohydrochloric Acid. (Syn., Acid. Nitrohydrochl. Dil., Diluted Nitromuriatic Acid; Fr. Acide Chlorazotique dilué; Ger. Verdünnte Saltpetersalzsäure.)

Manufacture: Mix in capacious glass vessel nitric acid 10 Ml. (Cc.), hydrochloric acid 45.5 Ml. (Cc.), and, after effervescence ceases, distilled water 194.5 Ml. (Cc.). It is a colorless, pale yellowish liquid, faint odor of chlorine, strongly acid taste and reaction, bleaching litmus; evaporate 20 Ml. (Cc.)—residue .0015 Gm.; it is a diluted aqueous solution containing hydrochloric acid, nitric acid, nitrosyl chloride, chlorine—8.5 p. c. of absolute acid. Should only be dispensed when 5 drops added to 1 Ml. (Cc.) of aqueous solution to potassium iodide immediately liberates iodine, and should be kept cool, in dark amber-colored, glass-stoppered bottles. Dose, ♏v–30 (.3–2 Ml. (Cc.)), well diluted.

Unoff. Prep.: Acidum Nitricum Dilutum, U. S. P. 1900, 10 p. c. (nitric acid 100 Gm., distilled water 580 Gm.), dose, ♏v–30 (.3–2 Ml. (Cc.)), well diluted.

Properties.—Tonic, antiseptic, astringent, cholagogue, escharotic; stains yellow.

Uses.—Intestinal indigestion with diarrhœa, syphilis, chronic hepatitis, intermittents, jaundice, scrofula, dysentery, whooping-cough, bronchitis, to allay thirst in fever, diabetes, diminishes phosphatic deposits in urine, gravel. Externally to destroy chancres, warts, hemorrhoids, phagedenic ulcers, bites of snakes and rabid dogs, tests for albumin in urine. As a lotion for ulcers, chilblains, and antiseptic purposes. Checks secretion of hydrochloric acid if given before meals.

Poisoning: Have burning acute pain over the entire affected tract, hiccough, nausea, vomiting (dark-colored mucous shreds, blood, etc.), swollen, tender cold abdomen, feeble pulse, clammy skin, difficult respiration, intense thirst; nearly always fatal. Give antidotes (alkaline solutions of sodium carbonate or bicarbonate, magnesium oxide, chalk), soap, mucilaginous drinks, almond or olive oil, emollient fomentations, morphine, stimulants, heat, avoid use of pump.

Incompatibles: Alcohol, alkalies, carbonates, oxides, ferrous sulphate, lead acetate.

CARBON.

$C^{iv} = 12.$

The element carbon (L. *carbo*, coal, Skt. *cra*, to cook) in the free state is of the greatest service in its several forms (official and non-official), while in combination it is of infinite importance, as it enters into the composition of many medical compounds.

Carbo Ligni. Wood Charcoal.—(Syn., Carbo Lig., Charcoal, Vegetable Charcoal, Carbo Præparatus, Carbo e Ligno; Br. Wood Charcoal; Fr. Charbon végétal, Charbon de Bois; Ger. Carbo Ligni pulveratus, Gepulverte Holzkohle, Präparirte Kohle.)

Manufacture: Charcoal is prepared from soft wood (willow, poplar, etc.) by exposure to red heat (300° C.; 572° F.) without access of air, then very finely powdered. In burning wood thus in a retort or under turf, the hydrogen and oxygen are driven off, leaving only carbon; if much air admitted there also will be considerable ash. It is a black, odorless, tasteless powder, very light, non-gritty, burning without luminous flame. *Tests:* 1. Boil 1 Gm. + potassium hydroxide T. S. (3) + distilled water (10)—filtrate only slightly brown. 2. Incinerate 1 Gm.—ash 7.5 p. c. Should be kept in well-closed vessels. Dose, gr. 15–60 (1–4 Gm.).

Preparations.—(Unoff.): *Trochisci Carbonis Ligni*—wood charcoal 30 Gm., tragacanth 4, sugar 66, vanillin .3, water q. s. 100 troches. *Biscuit. Capsules.* Mostly taken in water.

Properties.—Disinfectant, absorbent, deodorizer, decolorizer. Absorbs gases, condensing them within its pores, especially oxygen. When thus condensed, charcoal has an oxidizing action like ozone, parting readily with its oxygen in the presence of oxidizable substances. It easily oxidizes H_2S, thus decomposing organic matter when in the dry form.

USES.—Diarrhœa, dyspepsia with fetid breath, gastralgia, pyrosis, diabetes, constipation, nausea, intermittent fevers, worms, large doses purgative. Externally in dressing wounds, ulcers, gangrenous sores, fetid stools in typhoid fever, etc.

Allied Products:

1. *Carbo Animalis, Animal Charcoal, Bone—Ivory-black,* official 1820–1910.—Obtained from bones by boiling them in water to remove fat, placing them in iron cylinders which are subjected to intense heat without access of air; the volatile products (gases) escape through a small opening, while there remain in the retorts an ammoniacal aqueous liquid (bone spirit), a blackish tar (bone oil), and charcoal. It is a dull black granular, fine powder, odorless, almost tasteless, insoluble in water, alcohol; ignited yields grayish ash 85 p. c., soluble in hydrochloric acid by the aid of heat; contains carbon 10 p. c., calcium carbonate and phosphate 85–90 p. c. *Carbo Animalis Purificatus,* is much richer in carbon as the calcium salts have been removed by boiling gently for 10 hours animal charcoal 100 Gm., hydrochloric acid 300 Gm., water 600 Ml. (Cc.), adding water occasionally to maintain volume, washing and drying residue. It is a dull black, odorless, tasteless, insoluble powder. Great absorbent (coloring matter, alkaloids, bitter principles, metallic salts, glucosides, etc.—extracted by boiling in alcohol), poisoning by opium, aconite, strychnine, etc. Dose, gr. 15–60 (1–4 Gm.); for poisoning—give purified charcoal ℨss (15 Gm.) for each grain (.06 Gm.) of poison (alkaloid, etc.), let remain in stomach 10 minutes, remove by pump or emetic; if longer time allowed reabsorption may take place.

2. *Carbonei Disulphidum, Carbon Disulphide,* CS_2, official 1880–1910.—Obtained by heating charcoal to redness in a vertical cylinder and adding sulphur through a lateral tubule near the bottom; the sulphur melting and vaporizing, combines with the carbon and the carbon disulphide formed distils over through condensing tubes that collect the crude carbon disulphide but allows hydrogen sulphide to escape; it is then agitated with milk of lime, rectified over chlorinated lime solution, litharge, mercury, mercuric chloride, anhydrous copper sulphate, or 2 p. c. of a bland fixed oil, which removes sulphur and disagreeably smelling sulphur compounds. It is a clear, colorless, refractive, diffusive liquid, strong, characteristic, but not fetid odor, sharp, aromatic taste, soluble in alcohol, ether, chloroform, fixed or volatile oils, water (526), sp. gr. 1.256. Anæsthetic, rubefacient, antiseptic, anodyne, refrigerant, irritant, poisonous; mostly externally; opening abscesses, evulsion of nails, headache, toothache, neuralgia, enlarged lymphatics, goitre, lupoid, syphilitic growths, deafness due to lack of nervous energy; solvent for rubber, oils, etc.; internally —gastric cancer (pain), nausea, vomiting, gastralgia, enteric fever. Workmen exposed to its fumes have headache, vertigo, nervousness, voluble talking, incoherent singing, laughing, weeping, weakness, loss

of sexual power, impaired vision, hearing, memory, death. *Poisoning:* Powerful narcotic, causing sleep, coma, running, rapid, feeble pulse, stertorous breathing, loss of reflex action, cold, clammy sweat, low temperature, death. Give emetics, potassium bromide, hydrated chloral, stimulants, ammonia inhalation, warmth to body, cold douche to head, artificial respiration. Should be kept cool, remote from lights or fire, in partially filled, well-stoppered bottles or tin cans. Dose, ♏v–15 (.3–1 Ml. (Cc.)), well diluted.

SILICIUM. SILICON.

$Si^{iv} = 28.3$

The element silicon (L. *silex, silicis,* flint, which is nearly all silica = silicon oxide), like boron, resembles carbon. It is infusible, insoluble, non-volatile, and is met with in crystals as well as amorphous. It occurs mostly as silicon dioxide (silica), SiO_2—agate, amethyst, chalcedony, flint, quartz, rock crystal, sand, but also as silicates, which are silicic acid having its hydrogen replaced by metals—basalt, feldspar, granite, mica, porphyry, etc. Sodium silicate is the chief medicinal compound, although potassium silicate (fusing together potassium carbonate 10 parts, sand 15, charcoal 1) possesses similar properties. *Pumice stone, Pumex* (same composition as feldspar, obsidian—silica 60–80 p. c. + Al, Ca, Fe, K, Mg, Mn), is a porous, brittle, grayish-white volcanic mineral from Lipari Islands, Grecian Archipelago and Germany; used for abrading, polishing, filtering, tooth powder, etc.

PREPARATION.—(Unoff.): *Liquor Sodii Silicatis,* official 1880–1900. —Made by fusing sand or flint 1 part with dried sodium carbonate 2 parts, lixiviating the product with boiling water, filtering, evaporating. It is a semitransparent, yellowish or greenish viscid liquid, odorless, saline, alkaline, sp. gr. 1.350; contains sodium trisilicate and tetrasilicate 33 p. c., nitric acid precipitates silicic hydroxide. Should be kept in well-stoppered bottles.

PROPERTIES AND USES.—Sodium silicate arrests organic fermentation and putrefaction. Liquor—deodorant, antiseptic, antiferment, astringent, stimulant; chiefly in surgery for fixing bandages in fractures, coating in erysipelas, like collodion, injection in gonorrhœa, etc.

Terra Silicea Purificata. Purified Siliceous Earth, *official.* (Syn., Ter. Sil. Purif., Purified Kieselguhr, Purified Infusorial Earth, Diatomaceous Earth, Fossil Flour.)

Manufacture: This form of silica, SiO_2, consisting of frustules and fragments of diatoms, is purified by boiling with diluted hydrochloric acid, washing, calcining. It is a very bulky, fine powder, white, pale gray, pale buff, odorless, tasteless; contains 10 p. c. of moisture, but readily absorbs water, retaining 4 times its weight without becoming fluid; insoluble in water, acids, dilute alkaline solutions. *Test:* 1. Digest 1 Gm. with diluted hydrochloric acid 20 Ml. (Cc.) for 15 minutes, filter, evaporate to dryness 10 Ml. (Cc.), incinerate—residue .005 Gm. *Impurities:* Iron, carbonate, sulphate, moisture, organic substances.

Properties and Uses.—Excipient for pills containing easily reducible ingredients, potassium permanganate, salts of silver and gold; diluent to hygroscopic powders; filtering medium for obtaining sterile filtrates; preparing dynamite, "putz" pomade and other polishes, packing caustic and inflammable substances.

Talcum Purificatum. Purified Talc, *official.*—(Syn., Talc. Purif.; Fr. Talc purifié; Ger. Gereinigter Talk.)

Manufacture: Commercial talc (Soapstone, French Chalk), $4MgO.5SiO_2.H_2O$, is a native hydrous magnesium silicate, sometimes with a small amount of aluminum silicate, etc., from which it should be freed, when for pharmaceutical purposes, by boiling for 15 minutes 500 Gm. with boiling water 2500 Ml. (Cc.), gradually adding hydrochloric acid 50 Ml. (Cc.), allowing to stand for 15 minutes, decanting, rejecting supernatant liquid (containing the finer particles in suspension), boiling residue in water 2500 Ml. (Cc.) mixed with hydrochloric acid 25 Ml. (Cc.), allowing to stand for 15 minutes, rejecting liquid, washing residue by repeated decantation until acidity is removed (no opalescence with silver nitrate T. S.), transferring magma to muslin strainer, draining, drying at 110° C. (230° F.). It is a very fine, white, grayish-white powder, quite free from grittiness, slippery to the touch, adhering to the skin; odorless, tasteless; ignited at red heat—loses 5 p. c. *Impurities:* Iron, aluminum hydroxide, soluble substances.

Preparation.—(Unoff.): *Pulvis Talci Compositus,* 87 p. c., + boric acid 10, salicylic acid 3.

Properties and Uses.—Chiefly as an aid (medium) in filtering, for which a fineness greater than No. 100 is objectionable, as it passes through the filter requiring frequent pouring back; for dusting powder, the No. 60–80 is superior to the finer bolted varieties; native talc for extracting grease, oil spots, marking cloth (tailors), etc.

BORON.

$B^{iii} = 11.$

The element boron (L. *bor(ax)* + *on,* fr. Ar. *baraqa,* shine, glisten, substance from which the element first was obtained) resembles carbon very closely. It is infusible, non-volatile, insoluble, and is found sparingly in nature. Occurs as either boric (boracic) acid or sodium borate (borax). Chiefly in Italy and California.

Acidum Boricum. Boric Acid, H_3BO_3.—(Syn., Acid. Bor., Boracic Acid, Acidum Boracicum; Fr. Acide borique (crystallisé); Ger. Borsäure.)

Manufacture: Occurs in nature free and combined, but for medicine is prepared usually by dissolving sodium borate (borax) 10 parts in water 24, filtering while hot and adding hydrochloric acid 6; crystallize in a cool place, wash crystals with little cold water to remove adhering acid—$Na_2B_4O_7.10H_2O + 2HCl = 4H_3BO_3 + 2NaCl + 5H_2O$; yield 5–6 parts. Sulphuric acid may be used for hydrochloric, but adheres more persistently to the boric acid, necessitating two or three recrystallizations. It is in transparent, colorless scales (pearly lustre), 6-sided, triclinic crystals, white, bulky powder, slightly unctuous to touch; odorless; faintly bitter taste; permanent, soluble in water (18), boiling water (4), alcohol (18), boiling alcohol (6), glycerin (4); aqueous solution (1 in 50) slightly acid; contains 99.5 p. c. of H_3BO_3. *Tests:* 1. Volatilizes from boiling aqueous or alcoholic solution; dissolve in alcohol, glycerin—green flame. 2. Aqueous solution + little hydrochloric acid T. S. —turns turmeric paper reddish-brown on drying, changed to greenish-black by ammonia water. 3. At 100° C. (212° F.) loses H_2O, forming metaboric acid (hydrogen metaborate, HBO_2), which slowly volatilizes; at 160° C. (320° F.) fuses to glassy mass (tetraboric, pyroboric acid, hydrogen tetraborate, $H_2B_4O_7$); at higher temperature fused mass swells, loses all water and becomes boron trioxide, B_2O_3, which fuses into transparent, non-volatile, hygroscopic mass. *Impurities:* Heavy metals, arsenic, etc. Dose, gr. 5–30 (.3–2 Gm.).

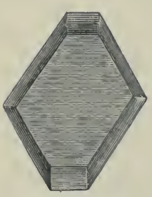


Fig. 443.—Boric acid crystal.

Preparations.—1. *Glyceritum Boroglycerini.* Glycerite of Boroglycerin. (Syn., Glycer. Boroglyc., Glycerite of Glyceryl Borate, Solution of Boroglyceride; Br. Glycerinum Acidi Borici; Fr. Glycéré (Soluté) de Boroglyceride; Ger. Boroglyceridlösung.)

Manufacture: 50 p. c. (glyceryl borate). Heat glycerin 46 Gm. to 150° C. (302° F.), add in portions, constantly stirring, boric acid 31 Gm., when dissolved, evaporate to 50 Gm., frequently stirring and breaking surface film, add glycerin 50 Gm., mix thoroughly—antiseptic. Should be kept in tightly-stoppered bottles.

2. *Unguentum Acidi Borici.* Ointment of Boric Acid. (Syn., Ung. Acid. Bor.; Fr. Onguent d'Acide borique; Ger. Borsalbe.)

Manufacture: 10 p. c. Melt paraffin 5 Gm., add white petrolatum 85 Gm., heat gently until liquefied, add hot liquid to boric acid 10 Gm., contained in a warm mortar, triturating thoroughly, stir until congealed.

Unoff. Preps.: Solutions, 1–5 p. c. *Suppositoria Boroglycerini,* each—glycerite of boroglycerin 1.25 Gm., glycerinated gelatin 1.67, glycerin 1.25.

Properties.—Antiseptic, poisonous.

Uses.—Dyspepsia, restores acidity to ammoniacal urine; externally —conjunctivitis, aphthous ulcers of mouth, diphtheria, vaginitis, otorrhœa, pharyngitis, burns, ulcers, boils, pruritus, urticaria, eczema, psoriasis, catarrhs, cystitis, gonorrhœa, erysipelas, tinea, fetid feet. Trituration with ether facilitates its powdering.

SULPHUR.

$S^{ii} = 32$.

The element sulphur (AS, *swefel*, fr. Skt. *culva*, copper, + *ari*, enemy to, or L. *sal*, salt, + Gr. *πῦρ*, fire, its combustible quality—brimstone, has same meaning, brynstone, burnstone) is found free in volcanic districts, as of Sicily, and universally in combination as sulphates, sulphides, etc. We have several official forms.

Sulphur Sublimatum. Sublimed Sulphur.—(Syn., Sulphur Sublim., Flowers of Sulphur, Flores Sulphuris, Brimstone; Fr. Soufre (sublimé), Fleurs (Crême) de Soufre; Ger. Sublimieter Schwefel, Schwefelblüte.)

Manufacture: It is prepared by subliming the crude sulphur and passing the vapors into large condensing chambers, thus leaving behind all earthly impurities save arsenic, which, when present, passes over as arsenic sulphide, also by oxidization during sublimation may have formed sulphurous and sulphuric acids, all of which must be removed. It is a fine, yellow powder, slight, characteristic odor, faintly acid taste, practically insoluble in water, nearly so in alcohol, slightly soluble in ether, soluble or partially soluble in carbon disulphide, chloroform, olive oil; contains, when dried to constant weight, 99.5 p. c. of pure sulphur. *Tests:* 1. Heated to 115° C. (240° F.)—fuses to yellow, mobile fluid, which becomes dark and viscid upon further heating. 2. Burns in the air to sulphur dioxide with characteristic odor; volatilize or ignite—residue .5 p. c. Dose, gr. 10–60 (.6–4 Gm.).

PREPARATIONS.—1. *Sulphur Lotum.* Washed Sulphur. (Syn., Sulphur Lot.; Fr. Soufre lavé; Ger. Sulfur depuratum, Gereinigter Schwefel (blumen), Flores Sulfuris Loti.)

Manufacture: Pass sublimed sulphur 100 Gm. through a No. 30 sieve, mix in a closed vessel with water 100 Ml. (Cc.), + ammonia water 10 Ml. (Cc.), set aside for 3 days, agitating occasionally, add water 100 Ml. (Cc.), wash on strainer with water until no blue to red litmus paper, drain, press, dry rapidly at moderate heat, pass through No. 30 sieve. This removes acid (sulphuric) impurities and arsenic—$H_2SO_4 + As_2S_3 + 8NH_4OH = (NH_4)_2SO_4 + (NH_4)_3AsO_3 + (NH_4)_3AsS_3 + 5H_2O$. It is a fine, yellow powder, odorless, tasteless, responding to solubility and identity tests of sublimed sulphur; contains, when dried to constant weight, 99.5 p. c. of pure sulphur. Should be kept in well-closed containers. Dose, gr. 10–60 (.6–4 Gm.).

Prep.: 1. *Pulvis Glycyrrhizæ Compositus*, 8 p. c.

2. *Sulphur Præcipitatum.* Precipitated Sulphur. (Syn., Sulphur Præc., Lac Sulphuris, Milk of Sulphur, Magisterium Sulphuris; Fr. Soufre précipité, Magistère (Lait) de Soufre; Ger. Gefällter Schwefel, Schwefelmilch.)

Manufacture: Slake calcium oxide 50 Gm., mix with water 500 Ml. (Cc.), add sublimed sulphur 100 Gm., previously sifted, mix thoroughly, add water 1000 Ml. (Cc.), boil for 1 hour, agitating frequently, and replacing evaporated water, let cool and clear by subsidence, add gradually to clear filtrate, constantly stirring, hydrochloric acid previously diluted with equal vol. of water until liquid nearly neutral, but alkaline and yellow, wash precipitate on strainer until washings are neutral and give no precipitate with ammonium oxalate T. S., dry rapidly.

(1) $3Ca(OH)_2 + S_{12} = 2CaS_5 + CaS_2O_3 + 3H_2O$.
hydroxide polysulphide, hyposulphite.
(2) $2CaS_5 + CaS_2O_3 + 6HCl = 3CaCl_2 + 3H_2O + S_{12}$, or
(3) $CaS_5 + 2CaS_2O_3 + 6HCl = S_6 + 2H_2O + H_2S + 2SO_2 + 3CaCl_2$.

It is a fine (finer than sublimed sulphur), amorphous powder, pale yellow, neutral, odorless, tasteless, responding to solubility and identity tests of sublimed sulphur, but more soluble in carbon disulphide; residue—.3 p. c.; contains, when dried to constant weight, 99.5 p. c. of pure sulphur. Should be kept in well-closed containers. Dose, gr. 10–60 (.6–4 Gm.).

3. *Unguentum Sulphuris.* Sulphur Ointment. (Syn., Ung. Sulphur.; Fr. Pommade soufree, Pomatum Sulfuratum; Ger. Unguentum Sulfuratum simplex, Schwefelsalbe.)

Manufacture: 15 p. c. Rub until thoroughly mixed sublimed sulphur 15 Gm. with benzoinated lard 85 Gm., gradually added.

Unoff. Preps.: Confectio Sulphuris (Br.), 45 p. c., dose, ʒj–2 (4–8 Gm.). *Trochiscus Sulphuris* (Br.), each contains precipitated sulphur gr. 5 (.3 Gm.). *Trochisci Sulphuris et Potassii Bitartratis:* washed sulphur 30 Gm., potassium bitartrate 6, sugar 60, tragacanth 4, oil of orange .5; water q. s. 100 troches. *Unguentum Sulphuris Alkalinum* 20 p. c., + potassium carbonate 10, water 5, benzoinated lard 65. *Unguentum Sulphuris Compositum,* 15 p. c., + precipitated calcium carbonate 10, oil of cade 15, soft soap 30, lard 30. *Petroxolinum Sulphuratum,* 3 p. c., + linseed oil 37, oleic acid 30, liquid petroxolin q. s. 100. *Petroxolinum Sulphuratum Compositum,* 10 p. c., +.

PROPERTIES.—Alterative, laxative, diaphoretic, resolvent, antiparasitic, stimulant. Much of it passes out of the system unchanged, a small part is converted into sulphides and hydrogen sulphide, this latter being excreted by the breath and skin, gives patients a disagreeable odor, and blackens all silver wearing effects; it increases peristalsis, making movements softer and more frequent. Sulphides after entering the blood are excreted in the urine as sulphates.

USES.—Constipation, hemorrhoids, pregnancy, anal fissure, stricture or prolapsus, lead-poisoning, chronic rheumatism, gout, bronchitis, asthma. Externally—scabies, diphtheria, sciatica, psoriasis, eczema, acne, sycosis, croup. The *washed* and *precipitated* forms are preferable for internal use, as they contain no arsenic; the latter is best for ointment, owing to its finer division.

Allied Products:

1. *Sulphuris Iodidum. Sulphur Iodide,* S_2I_2, official 1820–1910.—Obtained by triturating thoroughly together washed sulphur 20 Gm. iodine 80 Gm., heating mixture on water-bath at 60° C. (140° F.) until combined (uniform dark color), increasing heat until fused, pouring upon a cold surface. It is a subiodide (disulphide) occurring

in brittle masses, grayish-black, metallic lustre, crystalline fracture, iodine odor, acrid taste, insoluble in water, soluble in alcohol, carbon disulphide, ether, glycerin (60); solution of potassium iodide dissolves out the iodine, moderate heat dissipates while high heat leaves slight residue. Stimulant, caustic; substitute for iodine, acne, eczema, tinea capitis, lupus, lepra; ointment, 4 p. c.

Acidum Sulphuricum. Sulphuric Acid, H_2SO_4.—(Syn., Acid. Sulphuric., Oil of Vitriol, Vitriolic Acid; Fr. Acide sulfurique, Huile de Vitriol; Ger. Vitriolöl, Schwefelsäure.) A liquid containing 93–95 p. c. of H_2SO_4.

Manufacture: It is made by burning sulphur or pyrites, and oxidizing the SO_2 thus obtained by HNO_3, then passing this sulphuric oxide into steam, whereby sulphuric acid condenses in leaden chambers arranged for the purpose; from these it is drawn off and evaporated to the proper strength. In actual practice the SO_2 is passed over fumes of NO_2 arising from the decomposition of KNO_3 or $NaNO_3 + H_2SO_4$ in the presence of an abundant supply of air. The sulphurous oxide, SO_2, will not take up O to become sulphuric oxide, SO_3, from the air alone, hence this indirect method has to be used; the nitric acid is deoxidized into nitric oxide, and this unites with O of air to form nitric peroxide, while this again supplies fresh O to the sulphurous acid:

(1) $S_2 + O_4 = 2SO_2$. (2) $SO_2 + H_2O = H_2SO_3$. (3) $2NO + O_2 = 2NO_2$. (4) $H_2SO_3 + NO_2 = H_2SO_4 + NO$. (5) $3H_2SO_3 + 2HNO_3 = 3H_2SO_4 + H_2O + 2NO$. (6) $SO_2 + O + H_2O = H_2SO_4$.

In this process five things are evidently necessary: sulphur, nitre (HNO_3), air, watery vapor, heat. It is a colorless, odorless, oily liquid, very caustic, corrosive, strongly acid reaction, even when highly diluted; sp. gr. 1.83, miscible with water or alcohol with evolution of heat; must be added with caution to diluents, heated on platinum foil vaporizes with dense fumes; chars cane-sugar, wood, many organic substances. *Tests:* 1. Upon 3 Ml. (Cc.) pour carefully a layer of ferrous sulphate T. S., cool—zone of contact not brown, reddish-brown (abs. of nitric, nitrous acids). 2. Mixed with alcohol (4–5)—no precipitate within an hour (abs. of lead). *Impurities:* Heavy metals, lead, arsenic, hydrochloric, nitric, nitrous, sulphurous acids, non-volatile substances. Should be kept in glass-stoppered bottles. Dose, ♏ij–5 (.13–.3 Ml. (Cc.)), well diluted.

PREPARATIONS.—1. *Acidum Sulphuricum Dilutum.* Diluted Sulphuric Acid. (Syn., Acid. Sulph. Dil.; Fr. Acide sulfurique dilué; Ger. Verdünnte Schwefelsäure.)

Manufacture: Add gradually, constantly stirring, sulphuric acid 50 Gm. to distilled water 420 Gm., cool; contains 9.5–10.5 p. c. of H_2SO_4. It is a colorless, odorless liquid, strongly acid taste and reaction; sp. gr. 1.067. *Tests:* 1. With barium chloride T. S.—white precipitate insoluble in hydrochloric acid; with silver nitrate T. S. —not immediately affected (abs. of hydrochloric acid). 2. Evaporate 25 Ml. (Cc.), ignite residue—final residue .0015 (abs. of non-volatile substances). 3. 10 Ml. (Cc.) does not discharge at once the color of .1 Ml. (Cc.) of $\frac{N}{10}$ potassium permanganate V. S. (abs. of sulphurous, nitrous acids). *Impurities:* Same as for strong acid. Dose, ♏v–30 (.3–2 Ml. (Cc.)), well diluted.

2. *Acidum Sulphuricum Aromaticum.* Aromatic Sulphuric Acid. (Syn., Acid. Sulph. Arom., Elixir of Vitriol, Tinctura Aromatica Acida; Fr. Elixir vitriolique, Teinture (alcoolé) aromatique sulfurique; Ger. Elixir Vitrioli Mynsichti, Saure Aromatischetinktur, Mynsicht's Elixir.)

Manufacture: Add gradually sulphuric acid 10.9 Ml. (Cc.) to alcohol 70 Ml. (Cc.), cool, add tincture of ginger 5 Ml. (Cc.), oil of cinnamon .1 Ml. (Cc.), alcohol q. s. 100 Ml. (Cc.); contains free sulphuric acid and ethyl-sulphuric acid equivalent to 19–21 p. c. of H_2SO_4. It is a clear, reddish-brown liquid; pleasant, aromatic odor; strongly acid taste and reaction; sp. gr. 0.933; with barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. Should be kept in glass-stoppered bottles. Dose, ♏v–20 (.3–1.3 Ml. (Cc.)), well diluted.

Properties.—Powerful escharotic, charring black and destroying the parts touched, by abstracting water in the tissues and combining with the albumin; it promotes alkaline secretions, tonic, astringent, poisonous.

Uses.—Diarrhœa, hemorrhages, night-sweats, mucous discharges, cholera, quench thirst in fevers, cholera morbus, lead colic, gravel, stone, tapeworms, gastric disorders. Externally—ulcers, gangrene, cancer, caries of bone, ringworm, scabies (ointment 1 part to 8).

Poisoning: Similar to nitric acid. Give chalk, magnesium oxide or carbonate, alkaline carbonates, demulcent drinks, oils, egg-white, opium for pain, brandy or whisky for collapse; avoid pump.

Allied Product:

1. *Acidum Sulphurosum, Sulphurous Acid,* H_2SO_3, official 1860–1910.—This aqueous solution of sulphur dioxide, SO_2, 6.4 p. c., by weight, and water about 94 p. c., is obtained by heating in a flask sulphuric acid 60 Ml. (Cc.) and charcoal 20 Gm., passing the evolved gas through a wash-bottle containing water 50 Ml. (Cc.), thence into well-cooled distilled water 500 Ml. (Cc.), contained in a bottle of 1000 Ml. (Cc.) capacity, adding water q. s. to give 6.4 p. c., by weight, of sulphur dioxide. The charcoal acts as a reducing agent upon the sulphuric acid—$C + 2H_2SO_4 = 2SO_2 + 2H_2O$; sulphurous acid does not exist in the free state, but undoubtedly is present in solution when sulphur dioxide is passed into water. It is a colorless liquid, characteristic odor of burning sulphur, acid sulphurous taste, volatile, sp. gr. 1.028; exposed to air oxidizes to sulphuric acid of same strength (6.4 p. c.). Antiseptic, germicide, parasiticide, deoxidizant, disinfectant, destructive to plant-life, deodorizer (due to great affinity for oxygen, abstracting it from organic bodies), irritant (SO_2), arrests fermentation, putrefaction by destroying the germs—1 p. c. solution by volume, killing most micro-organisms; throat affections locally (spray, mop), diphtheria, chronic bronchitis, tonsillar ulcers, aphthæ, stomatitis, laryngitis, wounds, scabies, thrush, whooping-cough;

internally—urticaria, fermentative dyspepsia, flatulence, vomiting (frothy, yeasty). Should be kept cool, dark, in completely-filled, glass-stoppered, amber-colored bottles, and not dispensed unless of full strength (strong odor of burning matches—blue-head). Dose, ʒss–2 (2–8 Ml. (Cc.)), diluted with water; externally, diluted with water, glycerin, or fat.

PHOSPHORUS. PHOSPHORUS.

$P^{iii} = 31.$

(Syn., Phosphor.; Fr. Phosphore; Ger. Phosphor.)

The element phosphorus (Gr. *φῶς*, light, + *φέρειν*, to bring—*i. e.*, emits light in the dark) is official, and occurs in nature combined with various metals (Ca, Fe, Al, etc.), as phosphates, also in plants and animals, constituting about 60 p. c. of all bones in the form of tricalcium phosphate.

Manufacture: This is obtained by treating ground bones with H_2SO_4, when calcium sulphate is precipitated and calcium acid phosphate remains in solution. The latter is evaporated and distilled with sand and charcoal, thereby removing the oxygen and allowing the vaporized phosphorus to distil over, when it is condensed under water.

$$(1)\ \underset{\substack{\text{Tricalcium}\\ \text{phosphate.}}}{Ca_3 2PO_4} + 2H_2SO_4 = \underset{\substack{\text{Calcium}\\ \text{acid phosphate.}}}{CaH_4 2PO_4} + 2CaSO_4.$$

$$(2)\ CaH_4 2PO_4 + \text{heat} = \underset{\substack{\text{Calcium}\\ \text{metaphosphate.}}}{Ca2PO_3} + 2H_2O.$$

$$(3)\ 2(Ca2PO_3) + 2SiO_2 + 10C = 2CaSiO_3 + 10CO + 4P.$$

It is a translucent, nearly colorless solid, waxy lustre, consistence of beeswax (ordinary temperatures), surface, on long keeping, white, red, occasionally black, distinctive and disagreeable odor and taste (use for this only very dilute solution), on exposure emits white fumes, which are luminous in the dark with garlicky odor, on longer exposure often takes fire spontaneously, sp. gr. 1.830, melts at 44° C. (111° F.), soluble in dehydrated alcohol (400), chloroform (17), absolute ether (102), benzene (31.5), carbon disulphide (.9), sparingly in fixed oils, almost insoluble in water, to which it imparts its odor and taste. *Impurities:* Arsenic, sulphur (both due to sulphuric acid used). Should be kept carefully under water, cool, dark, in strong, well-closed containers. Dose, gr. $\frac{1}{100}$–$\frac{1}{30}$ (.0006–.002 Gm.).

Preparations.—1. *Pilulæ Phosphori.* Pills of Phosphorus. (Syn., Pil. Phosphor.; Fr. Pilules (phosphorées) au Phosphore; Ger. Phosphorpillen.)

Manufacture: Dissolve in test-tube, gently heating, phosphorus .06 Gm. in chloroform 5 Ml. (Cc.), replacing from time to time that which evaporates, add this to althæa 6 Gm. and acacia 3 Gm., previously mixed, then add mixture of glycerin 2 vols. + water 1 vol. q. s. (4 Ml.

(Cc.)) for 100 pills; dissolve balsam of tolu 10 Gm. in ether 15 Ml. (Cc.), and in sufficient quantity of this shake pills until coated, put on a plate, roll occasionally until dry; each pill contains $\frac{1}{100}$ gr. (.0006 Gm.). Should be kept in well-stoppered bottles. Dose, 1–5 pills.

Unoff. Preps.: Elixir, $\frac{1}{40}$ p. c., + chloroform .5, alcohol 34, glycerin 30, comp. spirit of orange 1, oil of anise .2, purified talc 3, dist. water q. s. 100, dose, ʒss–2 (2–8 Ml. (Cc.)). *Elixir Phosphori et Nucis Vomicæ*—tinct. nux vomica 3.5 p. c., elixir of phosphorus q. s. 100. *Liquor,* .07 p. c., spirit of peppermint .5, glycerin 64.50, dehydrated alcohol q. s. 100, dose, ♏x–15 (.6–1 Ml. (Cc.)). *Oleum Phosphoratum,* 1 p. c., + expressed oil of almond 90, ether 10, dose, ♏j–5 (.06–.3 Ml. (Cc.)). *Spirit,* $\frac{1}{8}$ p. c. (alcohol), dose, ♏viij–40 (.5–2.6 Ml. (Cc.)).

PROPERTIES.—Stimulant, tonic, nervine, diaphoretic, irritant, poisonous, nauseant, thickens and renders bones more dense, diminishes tissue-waste. A portion is oxidized into phosphoric acid, and as such enters the blood, some is dissolved by fats and oils that may happen in the stomach, thus being absorbed as phosphorus.

USES.—Sexual exhaustion, cerebral softening, mania, melancholia, nerve-debility from overwork, worry, typhoid conditions, scarlet fever, measles, chronic eczema, psoriasis, neuralgia, angina pectoris, aphrodisiac, locomotor ataxia.

Poisoning: Have intense intestinal irritation, vomiting, purging, skin cold, pulse feeble, rapid, syncope, death from exhaustion. Empty stomach, give hydrated magnesia, lime water, charcoal, copper sulphate, potassium permanganate, opium, and old (acid) oil of turpentine, this latter being its best antidote. No oils or fat should be used, as they dissolve the phosphorus, thus promoting its absorption. It is eliminated mostly by the urine as orthophosphoric acid, increasing excretion of urinary phosphates, hence evacuate bladder frequently.

Synergists: Restoratives, cod liver oil, arsenic, sulphur.

Acidum Phosphoricum. Phosphoric Acid, H_3PO_4.—(Syn., Acid. Phos.; Br. Acidum Phosphoricum Concentratum (66.3 p. c.); Fr. Acide phosphorique; Ger. Phosphorsäure.) A liquid containing 85–88 p. c. of H_3PO_4.

Manufacture: It is made by oxidizing phosphorus with diluted nitric acid; the two are heated together in a retort until nitrous fumes cease to be given off, and then concentrated or diluted to desired strength—$5HNO_3 + P_3 + 2H_2O = 3H_3PO_4 + 5NO$; 1 part phosphorus requires 3 parts strong nitric acid, which must be diluted in the process and added gradually, that coming over even being returned to the retort; the final evaporation is in a porcelain dish at 190° C. (374° F.), to drive out nitric acid; should a portion upon dilution remove within a minute the color of potassium permanganate, the product must be heated with additional nitric acid, to reduce phosphorous acid. It is a colorless, odorless, syrupy liquid, strongly acid taste and reaction, even when highly diluted; sp. gr. 1.72; heated loses water; at 200° C. (392° F.) begins to change to pyrophosphoric acid, and at higher temperature is converted into metaphosphoric acid, which volatilizes in dense fumes, or forms on cooling a transparent mass of glacial metaphosphoric acid. *Tests* and *Impurities:* Same as for the diluted acid. Should be kept in glass-stoppered bottles. Dose, ♏ij–5 (.13–.3 Ml. (Cc.)).

PREPARATIONS.—1. *Acidum Phosphoricum Dilutum.* Diluted Phosphoric Acid. (Syn., Acid. Phos. Dil.; Fr. Acide phosphorique médicinal; Ger. Verdünnte Phosphorsäure.)

Manufacture: Mix phosphoric acid 10 Gm., distilled water 76.5 Gm.; an aqueous solution containing 9.5–10.5 p. c. of H_3PO_4. It is a clear, colorless, odorless liquid; strongly acid taste and reaction; sp. gr. 1.057. *Tests:* 1. Supersaturate 3 Ml. (Cc.) with ammonia water, + magnesium sulphate T. S. (or magnesia mixture T. S.)—white, crystalline precipitate, which collected, washed and dissolved in diluted acetic acid, + silver nitrate T. S.—yellow precipitate (dist. from metaphosphoric, pyrophosphoric acids). 2. Warm gently 5 Ml. (Cc.), + few drops of silver nitrate T. S.—not turbid (abs. of phosphorous, hypophosphorous acids). *Impurities:* Heavy metals, arsenic, phosphates, metaphosphoric, pyrophosphoric, hydrochloric, phosphorous, hypophosphorous, nitric, sulphuric acids. Should be kept in well-stoppered bottles. Dose, ♏v–30 (.3–2 Ml. (Cc.)), well diluted.

Unoff. Preps.: Liquor Phosphatum Acidus, 12 p. c., + precipitated calcium carbonate 5, magnesium carbonate .5, dist. water q. s. 100. *Liquor Phosphatum Compositus,* 14 p. c., + ferric and ammonium phosphates each 3.5, citric acid 16.4, +. *Syrupus Phosphatum Compositus* (Chemical Food), 50 p. c., +. *Syrupus Phosphatum cum Quinina et Strychnina,* dose, ʒj–2 (4–8 Ml. (Cc.)).

Phosphoric acid when heated above 300° C. (572° F.) parts with its water, becoming glacial phosphoric acid (*Acidum Metaphosphoricum*)—$H_3PO_4 + \text{heat} = HPO_3 + H_2O$, which occurs in sticks or glassy lumps, hygroscopic; contains sodium metaphosphate and pyrophosphoric acid, readily soluble in water, gradually changing into phosphoric acid, coagulates egg-albumen.

PROPERTIES.—Tonic, alterative, refrigerant.

USES.—Dyspepsia, hysteria, diabetes, leucorrhœa, low fevers, scrofula, caries of bone, night-sweats, catarrhal affections, jaundice, melancholia, injection for sinuses, scrofulous joints, wash for ulcers.

Acidum Hypophosphorosum. Hypophosphorous Acid, HPH_2O_2.—(Syn., Acid. Hypophos.; Fr. Acide Hypophosphoreux; Ger. Unterphosphorigesäure.) An aqueous solution containing 20–32 p. c. of HPH_2O_2.

Manufacture: Dissolve calcium hypophosphite 138 Gm. in boiling water 900 Ml. (Cc.), add oxalic acid 103 Gm. dissolved in boiling water 400 Ml. (Cc.); boil mixture, evaporate filtrate to 358 Gm.—$Ca(PH_2O_2)_2 + H_2C_2O_4 = 2HH_2PO_2 + CaC_2O_4$; a weaker acid may be obtained by dissolving potassium hypophosphite (208) in water (588), tartaric acid (300) in diluted alcohol (600), mix, cool, filter—$KH_2PO_2 + H_2C_4H_4O_6 = HH_2PO_2 + KHC_4H_4O_6$. It is a colorless, slightly yellow, odorless liquid; intensely acid taste and reaction, even if highly diluted; sp. gr. 1.130; when heated water evaporates, and at 135° C. (275° F.) decomposes, forming hydrogen phosphide (which ignites) and phosphorous acid, the latter decomposing at 165° C. (329° F.) into hydrogen phosphide and phosphoric acid; at higher temperature the pasty residue reddens, ignites, burning out unoxidized phosphorus. *Tests* and *Impurities:* Same as for the diluted acid. Dose, ♏iij–20 (.2–1.3 Ml. (Cc.)).

Preparations.—1. *Acidum Hypophosphorosum Dilutum.* Diluted Hypophosphorous Acid, HPH_2O_2. (Syn., Acid. Hypophos. Dil.; Fr. Acide Hypophosphoreux dilué; Ger. Verdünnte Unterphosphorigesäure.)

Manufacture: Mix hypophosphorous acid 100 Gm. with distilled water 210 Gm. It is a colorless, odorless liquid, strongly acid taste and reaction; sp. gr. 1.042; aqueous solution containing 9.5–10.5 p. c. of HPH_2O_2. *Tests:* 1. With silver nitrate T. S.—black precipitate (silver). 2. With mercuric chloride T. S.—white precipitate (mercurous chloride). *Impurities:* Heavy metals, arsenic, barium, oxalic acid. Should be kept in well-stoppered bottles. Dose, ♏x–60 (.6–4 Ml. (Cc.)).

Preps.: 1. *Syrupus Ferri Iodidi,* 2 p. c. 2. *Syrupus Hypophosphitum,* $\frac{1}{5}$ p. c.

Properties and Uses.—Tonic, mostly in combination with strychnine, quinine, iron; nervous debility. In pharmacy as a reducing agent in analysis, and as a preservative to prevent decomposition of iodides in solution when exposed to light and air. A 50 p. c. acid is also made by evaporating carefully the 30 p. c. acid to three-fifths of its weight, or the 10 p. c. acid to one-fifth of its weight, sp. gr. 1.406.

Halogens or *Haloids.*—Chlorine, Bromine, Iodine, Fluorine. This group of four elements is one of very great importance in medicine and pharmacy. The word halogen is from Gr. ἅλις, the sea, in reference to their original source; thus chlorine is from sea-salt, bromine from sea-water, and iodine from seaweed; besides this they all have atomic weights of a common ratio—chlorine, 35.4; bromine, 79.8; iodine, 126.6; fluorine, 19, which compared with the last is as 1, 7, 4, 2, or 35.4 + 126.9 ÷ 2 gives 81, which is approximately the atomic weight of bromine. In addition, they possess strong chemical affinities and enter into the composition of a large number of useful compounds.

CHLORINE.

$Cl^i = 35.4.$

The element chlorine (Gr. χλωρός, light green—*i. e.,* color of the gas) is a greenish-yellow irrespirable gas, and as such is mainly useful as a reagent in the laboratory and for bleaching, deodorizing, or disinfecting. It is not official, but some of its compounds are.

Preparation.—(Unoff.): *Liquor Chlori Compositus* (*Chlorine Water*), official 1860–1910. Obtained by adding hydrochloric acid 2 Ml. (Cc.), diluted with distilled water 2 Ml. (Cc.), to potassium chlorate .7 Gm. in a 200 Ml. (Cc.) flask, placing this in boiling water 2–3 minutes and when filled with greenish-yellow gas removing from hot water and adding through funnel, fitting in stopper of flask and containing purified cotton 1 Gm., cold distilled water, 2 portions, 50 Ml. (Cc.) each; after each portion stopper flask, invert, agitate—$2KClO_3 + 4HCl = 2KCl + 2H_2O + 2ClO_3 + Cl_2$. Stimulant, antiseptic, disinfectant, irritant; typhus fever, liver affections, blood poisoning, scarlatina, fetid bronchitis, diphtheria, typhoid diarrhœa, dysentery, smallpox, phthisis; externally (well diluted)—gargle in smallpox, scarlet fever, putrid sore throat, wash for ulcers, cancers, buboes, abscesses, itching in skin diseases; chronic catarrh—in atomizer: ʒss; 2 Ml. (Cc.), hot water ℥j; 30 Ml. (Cc.).

Poisoning: When inhaled may have laryngeal irritation, œdema, asphyxia, black eschars, cough, sensation of constriction across chest, difficult deglutition; when swallowed, have burning sensation, possibly perforations of œsophagus and stomach. Inhale ammonia vapor, steam, fresh air, ether, chloroform; emetic, warm water, albumin (white of egg), milk, flour, lime water, stimulants, opium. *Incompatibles:* Salts of lead and silver. Dose, ʒss–1 (2–4 Ml. (Cc.)).

Acidum Hydrochloricum. Hydrochloric Acid, HCl.—(Syn., Acid. Hydrochl., Muriatic Acid, Spirit of (Sea) Salt, Marine Acid, Acidum Chlorhydricum, Chlorhydric Acid; Fr. Acide hydrochlorique—chlorhydrique—muriatique; Ger. Salzsäure, Chlorwasserstoffsäure.) An aqueous solution containing 31–33 p. c. of HCl.

Manufacture: Heat sodium chloride with sulphuric acid, wash evolved HCl gas and pass it into cold water—(1) $2NaCl + H_2SO_4 = 2HCl + Na_2SO_4$. (2) $NaCl + H_2SO_4 = HCl + NaHSO_4$. The latter equation is used mostly, as less heat is required and the more soluble sulphate formed is easily washed out from the retorts with a stream of water. Much crude acid is produced in the Lablanc soda factories, where sodium chloride and sulphuric acid are heated in cylinders to obtain sodium sulphate (salt-cake), the first step in making sodium carbonate. It is a colorless, fuming liquid; pungent odor; strongly acid taste and reaction, even when highly diluted; fumes and odor disappear on adding water (2); sp. gr. 1.155; heated with manganese dioxide—evolves chlorine. *Tests* and *Impurities:* Same as for the diluted acid. Should be kept in glass-stoppered bottles. Dose, ♏ij–5 (.13–.3 Ml. (Cc.)), well diluted.

Fuming hydrochloric acid contains 38.2 p. c. of HCl, is colorless, fuming strongly in the air, sp. gr. 1.195, used chiefly in chemical processes.

PREPARATIONS.—1. *Acidum Hydrochloricum Dilutum.* Diluted Hydrochloric Acid. (Syn., Acid. Hydrochl. Dil., Diluted Muriatic Acid; Fr. Acide chlorhydrique dilué; Ger. Verdünnte Salzsäure.)

Manufacture: Mix hydrochloric acid 100 Gm., distilled water 220 Gm. It is a colorless, odorless liquid, strongly acid taste and reaction; sp. gr. 1.049; contains 9.5–10.5 p. c. of HCl. *Tests:* 1. With silver nitrate T. S.—white, curdy precipitate, insoluble in nitric acid, readily soluble in ammonia water. 2. Evaporate 25 Ml. (Cc.)—residue .003 Gm. *Impurities:* Heavy metals, arsenic, free bromine, free chlorine, bromide, iodide, sulphates, sulphuric, sulphurous acids. Should be kept in glass-stoppered bottles. Dose, ♏v–30 (.3–2 Ml. (Cc.)), well diluted.

Prep.: 1. *Liquor Acidi Arsenosi,* 5 p. c.

2. *Argenti Nitras Fusus,* 4 p. c.

PROPERTIES.—Tonic, refrigerant, antiseptic, irritant, poisonous. Given before meals checks flow of gastric juice, diminishing acidity, but 2–3 hours after food increases the acidity; acts as gastric antiseptic, being in the gastric juice .2 p. c., aiding in the conversion of pepsinogen into pepsin, and of proteids into peptones; increases saliva, bile, pancreatic juice, checks fermentation, cleans tongue, allays thirst, combines with albumin or alkaline base of blood, lessening its alkalinity; prolonged use impairs digestion, constipates. The strong applied to the skin produces a blister, destroys tissue, whitens mucous membranes, causing necrosis and sloughing.

USES.—Low fevers, phthisis, syphilis, phosphatic deposits, acid dyspepsia, gastro-intestinal indigestion without diarrhœa (after meals), chronic gastric catarrh, gastric cancer, to quench thirst, skin diseases (eczema, psoriasis), diphtheria, stomatitis.

Poisoning: Similar to nitric acid. Give alkalies, magnesium oxide, sodium bicarbonate, soap, demulcent drinks, albumin, oil, milk; opium for pain, brandy or whisky for collapse.

Incompatibles: Oxidizable substances (explosive), alkalies, carbonates, salts of Ag, Ca, Pb, glucosides.

Synergists: Digestive ferments, vegetable bitters, gentian, nux-vomica, etc.

BROMUM. BROMINE.

$Br^{i} = 79.92.$

(Syn., Brominium; Fr. Brôme; Ger. Brom.)

The element bromine (Gr. βρῶμος, bad smell, stink—*i. e.*, its disagreeable odor), official 1840–1910, owing to powerful corrosive irritant properties, is employed seldom in the free state, but in combination with the metals, forming salts that are sedative, it is of great service in medicine. Obtained from sea-water, which contains $\frac{1}{175}$ p. c., by evaporating until most of the salts crystallize out, leaving bromides; or from mother-liquor (bittern) of salt-works, which contains bromides (chiefly of magnesium) by heating and passing chlorine into it, condensing the volatilized bromine under water—$MgBr_2 + Cl_2 = MgCl_2 + Br_2$. It is a heavy, brownish-red, mobile liquid, evolving always reddish irritating, suffocating fumes, odor of chlorine, sp. gr. 3.016, boils at 63° C. (145° F.), soluble in alcohol, ether, chloroform, carbon disulphide, water (90). *Poisoning:* Burning pain along entire alimentary tract, vomiting, purging, collapse, death, perforation may result; give ammonia water (diluted), demulcents, opium, atropine, strychnine, external heat. Should be kept cool, dark, in glass-stoppered bottles. Liquor Bromi, 8.3 p. c., + potassium bromide 12.5, water q. s. 100.

Acidum Hydrobromicum Dilutum. Diluted Hydrobromic Acid.—(Syn., Acid. Hydrobrom. Dil., Acidum Bromhydricum (dilutum); Fr. Acide hydrobromique dilué; Ger. Verdünnte Hydrobromsäure, Verdünnte Bromwasserstoffsäure.) An aqueous solution containing 9.5–10.5 p. c. of HBr.

Manufacture: Pour diluted sulphuric acid into a hot saturated solution of potassium bromide, and after 24 hours (potassium sulphate having crystallized out) distil the liquid in a glass retort—$2KBr + H_2SO_4 = 2HBr + K_2SO_4$; or pass H_2S into bromine and water—$10Br + 2H_2S + 4H_2O = 10HBr + H_2SO_4 + S$; or dissolve tartaric acid (10) and potassium bromide (8), each in cold distilled water (25), add acid solution to saline, shake, cool 24 hours (ice-water, ice-chest), filter—$KBr + H_2C_4H_4O_6 = HBr + KHC_4H_4O_6$; here is formed acid potassium tartrate which upon standing crystallizes out, leaving a supernatant 15 p. c. solution of hydrobromic acid. It is a colorless, odorless liquid; strongly acid taste and reaction; sp. gr. 1.076. *Tests:* 1. With silver nitrate T. S.—yellowish-white precipitate, insoluble in diluted nitric acid, slowly soluble in excess of stronger ammonia water, and readily soluble in 10 p. c. solution of sodium thiosulphate. 2. Evaporate 25 Ml. (Cc.)—residue .0025 Gm. *Impurities:* Heavy metals, arsenic, barium, free bromine, iodine, chloride, sulphuric acid. Should be kept dark, in amber-colored, glass-stoppered bottles. Dose, ʒss–1 (2–4 Ml. (Cc.)), in water or flavored syrup.

Pure hydrobromic acid is a colorless gas, having pungent irritating odor, producing, in a damp atmosphere, dense white fumes, sp. gr. 2.797; on distilling the official solution water and weak acid first pass over, and at 126° C. (259° F.) the strongest solution (acid) obtainable remains, 47.8 p. c., which may be distilled unchanged; an acid (solution) of 34 p. c. also is marketed.

Properties.—Sedative, narcotic, small doses stimulant.

Uses.—Very similar to potassium bromide, but does not depress like it. Epilepsy, nervousness, headache, tinnitus aurium, vomiting, whooping-cough, muscular spasms, neuralgia, bronchial coughs, cerebral hyperæmia, insomnia, irritable heart.

IODUM. IODINE.

$I^1 = 126.92.$

(Syn., Iodinium; Fr. Iode; Ger. Jodum, Jod.)

The element iodine (Gr. ἴον, violet, + εἶδος, form, likeness—*i. e.*, from its violet-colored vapor) is official, and occurs in nature combined with the metals sodium, potassium, magnesium, etc.

Manufacture: An important source is the ash (kelp) of seaweeds, which contains about $\frac{1}{204}$ of its weight of iodine; the weeds are dried, burnt at the lowest possible temperature, ash exhausted with hot water, solution filtered, evaporated, cooled, when the less soluble salts—potassium chloride, sodium carbonate, and sulphate crystallize out; to mother-liquor, containing sodium and magnesium iodides, heated in lead retorts to 60° C. (140° F.) manganese dioxide and sulphuric acid are added, when iodine distils over, being collected in glass receivers —$2NaI + 3H_2SO_4 + MnO_2 = I_2 + 12NaHSO_4 + MnSO_4 + 2H_2O$. Much iodine is now obtained in Chile from the mother-liquor of saltpetre, containing about 22 p. c. of sodium iodate, by treating it with sulphurous acid—$2NaIO_3 + 5H_2SO_3 = Na_2SO_4 + 4H_2SO_4 + I_2$; the liberated iodine is filtered or distilled off, and may be purified by mixing with potassium iodide and subliming. It is in heavy, bluish-black brittle, rhombic plates, metallic lustre, distinctive odor, sharp, acrid taste, sp. gr. 4.66, imparts deep brown, evanescent stain to the skin, slowly destroys vegetable colors; soluble in chloroform, ether, aqueous solutions of iodides, carbon disulphide (4), alcohol (12.5), glycerin (80), water (2950); solution in alcohol or aqueous solution of potassium iodide—reddish-brown color; in chloroform or carbon disulphide—violet color; contains 99.5 p. c. of iodine. *Tests:* 1. Volatilizes slowly at ordinary temperatures; fumes at 114° C. (237° F.), gradually dissipating in purple vapor, leaving residue .05 p. c. 2. Saturated aqueous solution + starch T. S.—blue color, discharged on boiling, but reappears upon cooling. *Impurities:* Chlorine, bromine, cyanogen iodide, moisture. Should be kept cool, in glass-stoppered bottles. Dose, gr. $\frac{1}{4}$–1 (.016–.06 Gm.).

PREPARATIONS.—1. *Liquor Iodi Compositus.* Compound Solution of Iodine. (Syn., Liq. Iodi Co., Lugol's Solution; Br. Tinctura Iodi Fortis, Strong Tincture of Iodine, Liniment of Iodine, Liquor Iodinii Compositus; Fr. Soluté ioduré de Lugol; Ger. Lugolsche Jodlösung.)

Manufacture: 5 p. c. Dissolve iodine 5 Gm., potassium iodide 10 Gm., in distilled water q. s. 100 Gm. It is a transparent liquid, deep brown, iodine odor; aqueous solution containing 4.8–5.2 p. c. of iodine, and 9.8–10.2 p. c. of potassium iodide. *Test:* 1. Add 1 drop to 1 Ml. (Cc.) of starch T. S. diluted with water 10 Ml. (Cc.)—deep blue color. Should be kept dark, in glass-stoppered bottles. Dose, ♏j–10 (.06–.6 Ml. (Cc.)); mostly used externally.

2. *Tinctura Iodi.* Tincture of Iodine. (Syn., Tr. Iodi, Tinctura Iodinii; Fr. Teinture d'Iode; Ger. Jodtinktur.)

Manufacture: 7 p. c. Dissolve potassium iodide 5 Gm. in distilled water 5 Ml. (Cc.), add iodine 7 Gm., agitate until solution effected, add alcohol q. s. 100 Ml. (Cc.), mix thoroughly. It is an alcoholic solution of iodine, 6.5–7.5 Gm., and potassium iodide, 4.5–5.5 Gm., in the 100 Ml. (Cc.). Dose, ♏j–5 (.06–.3 Ml. (Cc.)); mostly used externally.

3. *Unguentum Iodi.* Iodine Ointment. (Syn., Ung. Iodi, Unguentum Iodinii; Fr. Pommade d'Iode; Ger. Jodsalbe.)

Manufacture: 4 p. c. Triturate until dissolved iodine 4 Gm., potassium iodide 4 Gm., glycerin 12 Gm., in a glass mortar, gradually incorporate benzoinated lard 80 Gm., mix thoroughly; avoid metallic utensils and containers, and only dispense when freshly made.

Unoff. Preps.: Collodium Iodi, 5 p. c., + flexible collodion 95. *Liquor Iodi Phenolatus*, $\frac{1}{30}$ p. c. (comp. solution of iodine 1.5 Ml. (Cc.)), + liquefied phenol .6, glycerin 16.5, water q. s. 100. *Petroxolinum Iodi*, 10 p. c., + oleic acid 40, alcohol 20, light liquid petrolatum 23, oil of lavender 2, stronger ammonia water 5. *Tinctura Iodi Fortior* (*Churchill's Tincture*), 16.5 p. c., + potassium iodide 3.3, water 25, alcohol q. s. 100. *Tinctura Iodi Decolorata*, 8.3 p. c., + sodium thiosulphate 8.3, water 10, stronger ammonia water 6.5, alcohol q. s. 100. *Syrupus Iodotannicus*, .27 p. c., tannic acid .54, sugar 80, dist. water q. s. 100.

PROPERTIES.—Antiseptic, counter-irritant, causing itching, smarting of the skin, corrosive, alterative, absorbent. Rapidly absorbed by mucous membranes, in the blood combined with sodium; eliminated in urine, saliva, milk, by intestinal and nasal mucous membranes.

USES.—Mostly external; enlarged glands, chronic abscesses, swollen joints, chilblains, ringworm, chronic pneumonia, lung affections, boils, carbuncles, suppurating glands, hydrocele, ovarian cyst, hernia, dropsy of the joints, large chronic bronchocele, chronic abscesses, fistulæ, wounds of venomous serpents, bites of rabid animals, hydrocephalus, chronic dysentery, diarrhœa.

Poisoning: Have metallic taste, pain in throat and stomach, salivation, intense thirst and gastro-enteritis, vomiting, purging, pale face, suppressed urine, vertigo, faintness, feeble and rapid pulse, fever, cyanosis, swollen eyelids, convulsive movements, collapse. Give emetics, starch, flour, arrowroot mixed with water, induce vomiting, sodium bicarbonate, hypodermic ammonia, stimulants (strychnine, digitalis, alcohol, atropine), morphine, demulcents, heat.

Incompatibles: Ammonia, mineral acids, metallic salts, alkaloids, forming insoluble compounds with most of these. Iodides with mineral acids, acid salts, bismuth subnitrate, alkaloids, silver nitrate, soluble lead salts, potassium chlorate, spirit nitrous ether, licorice.

II. METALS AND THEIR COMPOUNDS (SALTS).

These are treated also in natural groups, which associate those together having the strongest points of relationship. Thus in regular sequence we have:

LIGHT METALS.

Alkali Metals.	*Alkaline Earth Metals.*	*Earth Metals.*
K, Na, Li, (NH_4).	Ba, Ca, Sr, (Mg).	Al, and some rare metals.
Oxides, carbonates, and most salts soluble.	Oxides soluble, carbonates insoluble.	Oxides insoluble.

HEAVY METALS.

<table>
<tr><th>Iron Group.</th><th>Lead Group.</th><th>Arsenic Group.</th></tr>
<tr><td>Fe, Co, Ni, Mn, Cr, U, Zn.</td><td>Cd, Pb, Cu, Bi, Ag, Hg.</td><td>As, Sb, Sn, Au, Pt, Mo.</td></tr>
<tr><td>Sulphides soluble in dilute acids.</td><td colspan="2">Sulphides insoluble in dilute acids.</td></tr>
<tr><td></td><td>Sulphides insoluble in ammonium sulphide.</td><td>Sulphides soluble in ammonium sulphide.</td></tr>
</table>

POTASSIUM (Kálium).

$K^i = 39.1$.

Potassium (L. for potash—*pot* + *ash*—*i. e.*, origin of the salts by evaporating wood-ash lye in pots; Ar. *kali*, L. *kalium*, ashes) occurs in nature to a great extent as a double silicate of potassium and aluminum (granitic rocks, feldspar, etc.), also as chloride, nitrate, bitartrate, and carbonate, the latter being the predominant salt in wood-ashes. The metal is obtained by heating this carbonate with carbon in iron retorts, passing the evolved vapors into coal-oil in order to condense the metal —$K_2CO_3 + 2C = 2K + 3CO$. Plants derive much of their potassium from these disintegrated rocks, containing the silicate, which is absorbed by falling rain; this percolates through the soil, and from that the plant-roots (rootlets, trichomes) in turn take it. Potassium occurs also in native wood, chiefly as the acetate, but to some extent as sulphate, chloride, tartrate, citrate, etc., most of which upon incineration become converted into the carbonate.

Tests for Potassium Salts: 1. With platinic chloride, alcohol, and HCl, get a yellow crystalline precipitate ($PtCl_4 2KCl$). 2. With strong solution of tartaric acid, get a white crystalline precipitate of cream of tartar—alcohol facilitates the precipitation. 3. The flame of a Bunsen burner is colored violet, which can be recognized, even though sodium be present, through the intervention of blue glass or indigo solution. 4. Potassium salts are soluble in water, non-volatile, and usually white.

Potassii Carbonas. Potassium Carbonate, K_2CO_3.—(Syn., Pot. Carb., Salt of Tartar, Carbonas Potassicus (Kalicus), Potassii Carbonas Purus, Sal Tartari; Fr. Carbonate de Potasse; Ger. Kalium carbonicum, Kaliumcarbonat, Kohlensaures Kali.)

Manufacture: This is obtained by percolating wood-ashes with water, which takes up the potassium carbonate together with a little chloride, sulphate, also the sodium salts, while calcium and magnesium carbonates, phosphates, and sulphates, together with silica, are left behind. This percolate (lye) is evaporated, giving *crude potash* (*Kalium carbonicum crudum, Pottasche*, Ger.), which by calcining becomes *pearl-ash*, and this in turn purified yields the official carbonate. It may also be derived from residual ash in beet-sugar manufacture, or washings of sheep-wool, or from the native chloride by Leblanc's process for sodium carbonate, and likewise from the purer bicarbonate by heat—$2KHCO_3 = K_2CO_3 + H_2O + CO_2$. It is a white granular powder, odorless, strongly alkaline taste, very deliquescent, soluble in water (.9), boiling water (.7), insoluble in alcohol, aqueous solution (1 in 20) strongly alkaline to litmus and phenolphthalein T. S., effervesces with acids; contains, when dried, 99 p. c. of pure salt, but may have 15 p. c. of moisture. *Tests:* 1. Heat to 180° C. (356° F.)—loses all water; at bright red heat—melts; at white heat—volitilizes, imparting violet flame with a possible transient yellow tinge. 2. Aqueous solution

(1 in 10) with excess of tartaric acid T. S.—white crystalline precipitate of potassium bitartrate. *Impurities:* Heavy metals, earthy substances. Should be kept in air-tight containers. Dose, gr. 10–30 (.6–2 Gm.); externally in solution (2 p. c. + water), ointment (2–12 p. c. + lard).

PREPARATIONS.—1. *Pilulæ Ferri Carbonatis,* 1¼ gr. (.075 Gm.). 2. *Syrupus Rhei,* 1 p. c. 3. *Syrupus Rhei Aromaticus,* .1 p. c.

Unoff. Prep.: Liquor Potassæ Chlorinatæ—dissolve potassium carbonate 58 Gm. in boiling water 300 Ml. (Cc.), add it to chlorinated lime 80 Gm. mixed with water 400 Ml. (Cc.), shake, cool, add water q. s. 1000.

USES.—Chiefly in the preparation of the other potassium salts, also as an antacid in dyspepsia, diuretic in dropsy, antilithic in uric acid gravel, jaundice; externally in cutaneous affections, caustic, irritant poison.

Poisoning: Same as for potassium hydroxide. Give antidotes—fixed oils, vegetable acids, lemon juice, vinegar, demulcents.

Potassii Bicarbonas. Potassium Bicarbonate, $KHCO_3$.—(Syn., Pot. Bicarb., Acid Carbonate of Potassium, Kali Carbonicum Acidulum, Bicarbonas Potassicus (Kalicus); Fr. Bicarbonate de Potasse; Ger. Kalium bicarbonicum, Kaliumbicarbonat, Doppelt-Kohlensaures Kali.)

Manufacture: Pass carbon dioxide through strong solution of potassium carbonate, when the less soluble bicarbonate precipitates—$K_2CO_3 + H_2O + CO_2 = 2KHCO_3$. It is in colorless, transparent, monoclinic, odorless prisms, or white, granular powder, saline, slightly alkaline taste, permanent, soluble in water (2.8), hot water (2), almost insoluble in alcohol; contains 99 p. c. of pure salt. *Tests:* 1. Aqueous solution (1 in 10) slightly alkaline to litmus, neutral or slightly alkaline to phenolphthalein T. S.; effervesces with acids; heated above 50° C. (122° F.) rapidly loses carbon dioxide and water, and at boiling salt is converted into normal carbonate. 2. Heated to 100° C. (212° F.) salt loses carbon dioxide and water, and at red heat yields residue of carbonate, which gives violet flame; aqueous solution with excess of tartaric acid T. S.—white, crystalline precipitate of potassium bitartrate. *Impurities:* Heavy metals, carbonate, etc. Should be kept in well-closed containers. Dose, gr. 5–60 (.3–4 Gm.), well diluted.

PREPARATIONS.—1. *Liquor Potassii Arsenitis,* 2 p. c. (+ arsenous acid 1 p. c.). 2. *Liquor Potassii Citratis,* 8 p. c. of bicarbonate. 3. *Liquor Magnesii Citratis.* 38.5 gr. (2.5 Gm.) of bicarbonate to each bottle.

USES.—As the purest source of the potassium salts, similar to carbonate, but has milder taste and is more acceptable to the stomach. Used in beverages, laxative draughts, etc.

Potassii Hydroxidum. Potassium Hydroxide, KOH.—(Syn., Pot. Hydrox., Caustic Potash, Potassium Hydrate, Potassa, Kali Hydricum Fusum (Purum), Oxydum Potassicum, Lapis Causticus Chirurgorum; Br. Potassa Caustica; Fr. Potasse caustique (fondue), Pierre à Cautère; Ger. Kali causticum fusum, Kaliumhydroxyd, Ätzkali.)

Manufacture: Evaporate liquor potassii hydroxidi to dryness, then pour into molds and quickly bottle to prevent deliquescence. It may also be made by action of the metal potassium on water, and evaporating—$K + H_2O = KOH + H$. It is in dry, white or nearly white flakes, fused masses, sticks, hard, brittle, crystalline fracture, odorless (handle and taste very cautiously, as it rapidly destroys organic tissues), on exposure readily absorbs carbon dioxide and moisture (deliquesces), soluble in water (.9), boiling water (.6), alcohol (3), glycerin (2.5), boiling alcohol; aqueous solution strongly alkaline; contains 85 p. c. of pure salt. *Tests:* 1. Aqueous solution (1 in 10) added to excess of tartaric acid T. S.—white, crystalline precipitate, redissolved by excess of potassium hydroxide. 2. Imparts violet flame. *Impurities:* Heavy metals, organic matter, insoluble substances. Should be kept in well-closed containers—bottles made of hard glass. Dose, gr. 1–2 (.06–.13 Gm.), well diluted.

PREPARATIONS.—1. *Liquor Potassii Hydroxidi.* Solution of Potassium Hydroxide. (Syn., Liq. Pot. Hydrox., Liquor Potassæ, Solution of Potassa, Solution of Potassium Hydrate, Solution of Caustic Potash, Kali Hydricum Solutum, Lixivium Causticum; Fr. Potasse caustique liquide, Lessive caustique; Ger. Liquor Kali caustici, Kalilauge, Ätzkalilauge.)

Manufacture: 5 p. c. Dissolve potassium hydroxide 6 Gm. in distilled water q. s. 100 Gm. It is a clear, colorless, odorless, aqueous liquid (solution), very acrid, caustic taste (even if largely diluted, when it only should be tasted), strongly alkaline, readily absorbs carbon dioxide from the air, sp. gr. 1.046; contains not less than 4.5 p. c. of potassium hydroxide. *Impurities:* Carbonate, etc. Should be kept in bottles made of hard glass, with rubber stoppers, or glass stoppers coated with petrolatum. Dose, ♏v–30 (.3–2 Ml. (Cc.)), well diluted.

2. *Liquor Cresolis Compositus*, 8 p. c.

Unoff. Prep.: Potassa with Lime, each 50 p. c.; used externally.

PROPERTIES.—Potassium hydroxide is one of our strongest caustics or escharotics; destroys tissues by abstracting moisture and dissolving albumin, fibrin, and gelatin. Its action differs from that of silver nitrate in not being superficial, but in penetrating deeply. Internally—before meals stimulates acid secretions, at the end or after meals neutralizes gastric juice already secreted; renders blood alkaline in which it circulates (possibly as carbonates); renders urine alkaline, increasing its power of holding uric acid in solution; promotes waste, bronchial secretions, checks saliva.

USES.—To cauterize chancres, poisoned wounds, ingrown nails, scrofulous abscesses, carbuncles, tumors, varicose veins, diphtheria, urethral stricture, corns. Internally, as an antacid in acid dyspepsia, calculous disorders. Liquor—used similarly, but owing to less strength has a much milder action; potassa with lime—acts more strongly and is less deliquescent than the pure salt.

Poisoning: Similar to ammonia. Have sensation of heat in throat, vomiting, diarrhœa, abdominal pain, feeble, quick pulse, clammy skin, tongue, lips, and throat swollen, soft, red. Give emetics, or wash out stomach, weak acids, lemon juice, vinegar, demulcents, oils, flaxseed tea, egg-white.

Incompatibles: Acids, acid salts, metallic salts, preparations of ammonia, belladonna, hyoscyamus, scopola, and stramonium (alkaloids being decomposed, and all alkaloids being precipitated by alkalies).

Potassa Sulphurata. Sulphurated Potassa.—(Syn., Pot. Sulphurat., Liver of Sulphur, Sulphuret of Potassium, Hepar Sulphuris; Fr. Sulfure de Potasse, Foie de Soufre; Ger. Kalium sulfuratum, (Kali) schwefelleber.

Manufacture: Mix sublimed sulphur 100 Gm. with dried potassium carbonate 200 Gm., heat until fused, pour on a cold marble slab—$3K_2CO_3 + S_8 = 2K_2S_3 + K_2S_2O_3 + 3CO_2$. This indefinite chemical compound, a mixture chiefly of potassium polysulphides, K_2S_3 +, and thiosulphate, $K_2S_2O_3$, is in the form of irregular pieces, liver-brown when fresh, changing to greenish-yellow and gray by absorbing moisture, oxygen, and carbon dioxide; strong odor of hydrogen sulphide, bitter, acrid, alkaline taste; soluble in water (slight residue), alcohol dissolves only the sulphides; contains sulphides corresponding to 12.8 p. c. of sulphur. *Tests:* 1. Aqueous solution (1 in 10) is light brown and strongly alkaline, and with excess of acetic acid—brisk evolution of hydrogen sulphide and precipitation of sulphur: filtrate + sodium bitartrate T. S.—white, crystalline precipitate on standing. Dose, gr. 3–10 (.2–.6 Gm.); externally in lotion, bath, ointment.

Properties and Uses.—Irritant, increases pulse, cutaneous circulation and heat, also mucous secretions: large doses sedative, laxative; chronic rheumatism, gout, cutaneous affections, painter's colic, asthma, chronic nasal catarrh, infantile croup, paralysis, scabies, scrofula, chronic bronchitis, whooping-cough, ascarides by injection.

Potassii Acetas. Potassium Acetate, $KC_2H_3O_2$.—(Syn., Pot. Acet., Sal Diureticus, Terra Foliata Tartari, Acetas Potassicus (Kalicus); Fr. Acétate de Potasse; Ger. Kalium Aceticum, Kaliumacetat, Essigsaures Kali.)

Manufacture: Almost neutralize acetic acid with potassium carbonate (or bicarbonate), evaporate the solution to dryness, and fuse —(1) $K_2CO_3 + 2HC_2H_3O_2 = 2KC_2H_3O_2 + H_2O + CO_2$. (2) $KHCO_3 + HC_2H_3O_2 = KC_2H_3O_2 + H_2O + CO_2$. It is a white powder or in crystalline masses of satin-like lustre, odorless, warming, saline taste, very deliquescent, soluble in water (.5), boiling water (.2), alcohol (2.9); contains 99 p. c. of pure salt. *Tests:* 1. Aqueous solution (1 in 20) alkaline to litmus, no effect on phenolphthalein T. S. 2. Fuses with slight heat, at higher temperature decomposes with inflammable empyreumatic vapors, and black residue of potassium carbonate and carbon, which gives violet flame, is alkaline and effervesces with acids.

3. Aqueous solution (1 in 5) and sodium bitartrate T. S. each 5 Ml. (Cc.)—white crystalline precipitate; heat .1 Gm. with sulphuric acid and alcohol each 1 Ml. (Cc.)—ethyl acetate, recognized by odor. *Impurities:* Heavy metals, arsenic, etc. Should be kept in air-tight containers. Dose, gr. 10–60 (.6–4 Gm.); laxative, ʒij–4 (8–15 Gm.).

Preparations.—(Unoff.): *Elixir Potassii Acetatis,* 8.5 p. c., + aromatic elixir q. s. 100, dose, ʒij–4 (8–15 Ml. (Cc.)). *Elixir Potassii Acetatis et Juniperi,* 8.5 p. c., + fldext. juniper 12.5, +.

Properties.—Diuretic, diaphoretic, aperient, non-irritating, antiscorbutic; renders urine alkaline, preventing and dissolving uric acid precipitates (gravel).

Uses.—Dropsies (not so good as the bitartrate), acute rheumatism, gout, liver derangements, jaundice, congestion of spleen, uterus, and hemorrhoidal vessels, skin diseases (eczema, psoriasis, lepra), febrile affections, to render urine alkaline. All organic acid salts are believed to be converted into carbonates in the stomach.

Potassii Citras. Potassium Citrate, $K_3C_6H_5O_7 + H_2O$.—(Syn., Pot. Cit., Kalium Citricum, Citras Potassicus (Kalicus); Fr. Citrate de Potassium; Ger. Kaliumcitrat, Citronsaures Kali.)

Manufacture: Saturate to neutrality a solution of citric acid with potassium carbonate (or bicarbonate), filter, evaporate, granulate—(1) $3K_2CO_3 + 2H_3C_6H_5O_7,H_2O = 2K_3C_6H_5O_7,H_2O + 3H_2O + 3CO_2$. (2) $3KHCO_3 + H_3C_6H_5O_7,H_2O = K_3C_6H_5O_7 + 4H_2O + 3CO_2$. It occurs in transparent, prismatic crystals or white granular powder, odorless, cooling, saline taste, deliquescent, soluble in glycerin, water (.6), almost insoluble in alcohol; aqueous solution (1 in 20) alkaline to litmus, not reddened by 1 drop of phenolphthalein T. S.; contains, when dried, 99 p. c. of crystallized salt. *Tests:* 1. Heat to 200° C. (392° F.)—loses water of crystallization; at higher heat—decomposes, turns brown, carbonizes, emits inflammable gases of pungent, acrid odor; at red heat—residue of alkaline reaction, strongly effervescing with acids. 2. Aqueous solution (1 in 10) with sodium bitartrate T. S.—white, crystalline precipitate; aqueous solution (1 in 20) and calcium chloride T. S. each 10 Ml. (Cc.)—liquid remains clear until boiled, then white, granular precipitate. *Impurities:* Heavy metals, arsenic, tartrate. Should be kept in well-closed containers. Dose, gr. 10–60 (.6–4 Gm.); mild laxative, ʒj–2 (4–8 Gm.).

Preparation.—1. *Potassii Citras Effervescens.* Effervescent Potassium Citrate. (Syn., Pot. Cit. Eff.; Fr. Citrate de Potasse Effervescent; Ger. Brausendes Kaliumcitrat.)

Manufacture: Dry potassium citrate 20 Gm. until it ceases to lose weight, powder and mix with powdered citric acid 16.2, tartaric acid 25.2, then with sodium bicarbonate 47.7, heat in oven 93–104° C. (199–219° F.); when mixture moist from careful manipulation with wooden spatula, rub through No. 6 tinned-iron sieve, dry granules at 54° C. (130° F.). Should be kept in well-sealed containers to avoid contact with moist air. Dose, gr. 10–60 (.6–4 Gm.).

Liquor Potassii Citratis. Solution of Potassium Citrate.—(Syn., Liq. Pot. Cit., Mistura Potassii Citratis, Neutral Mixture, Liquor Kali Citrici; Fr. Citrate de Potassium liquide; Ger. Kaliumcitratlösung.)

Manufacture: Dissolve potassium bicarbonate 8 Gm., citric acid 6 Gm., each, in distilled water 40 Ml. (Cc.), filter solutions separately, wash each filter with distilled water q. s. 50 Ml. (Cc.), mix solutions, when effervescence ceases transfer to bottle and stopper tightly. It is a clear, colorless, aqueous liquid (solution), odorless, mildly saline taste, slightly acid reaction; contains 8 p. c. of citrate of potassium, with small amounts of citric and carbonic acids; must not be dispensed unless recently prepared. Dose, ʒss–2 (15–60 Ml. (Cc.)).

Properties.—Refrigerant, diaphoretic, diuretic, antiscorbutic, arterial sedative, similar to the acetate.

Uses.—Febrile affections (this action is increased with sweet spirit of nitre or antimonial wine), remittent, intermittent fevers with hot, dry skin. If given with lemon juice, beneficial in rheumatism, uric acid diathesis, acute bronchitis (first stages).

Potassii Bitartras. Potassium Bitartrate, $KHC_4H_4O_6$.—(Syn., Pot. Bitart., Cream of Tartar, Acid Potassium Tartrate, Supertartrate of Potassa, Crystals of Tartar, Kali Bitartaricum, Bitartras Potassicus (Kalicus), Cremor Tartari; Br. Potassii Tartras Acidus; Fr. Bitartrate de Potasse, Pierre de Vin; Ger. Tartarus depuratus, Weinstein.)

Manufacture: By purifying argol (crude tartar), which deposits in wine casks as a result of fermenting grape-juice. This argol is taken from the sides and bottom of the casks, boiled in water, clay added to precipitate coloring matter, filtered through animal charcoal, crystallized; to remove the 5–15 p. c. calcium tartrate present, dissolve in boiling water, add 8–10 p. c. hydrochloric acid, stir while cooling. It is in colorless or slightly opaque, rhombic crystals, or a white, somewhat gritty powder, odorless, pleasant, acidulous taste, permanent, soluble in water (155), boiling water (16), alcohol (8820); saturated aqueous solution acid; contains 99.5 p. c. of pure salt. *Tests:* 1. Heat on platinum foil—chars with inflammable vapors having odor of burning sugar; at higher temperature, with free access of air, carbon of black residue is consumed leaving a white, fused mass of potassium carbonate, which is alkaline and effervesces strongly with acids. 2. Aqueous solution with cobaltic nitrite T. S.—yellow precipitate; neutralize saturated aqueous solution with potassium hydroxide T. S., add silver nitrate T. S. + ammonia water q. s. to dissolve white precipitate, boil—silver deposits as mirror on sides of test-tube. *Impurities:* Heavy metals, lead, alum, starch, kaolin, calcium phosphate, other insoluble matter. Should be kept in well-closed containers. Dose, aperient, gr. 10–60 (.6–4 Gm.); hydragogue cathartic, ʒss–4 (2–15 Gm.); diuretic, gr. 10–60 (.6–4 Gm.), ter die.

Preparation.—1. *Pulvis Jalapæ Compositus*, 65 p. c.

Potassii et Sodii Tartras. Potassium and Sodium Tartrate, $KNaC_4H_4O_6 + 4H_2O$.—(Syn., Pot. et Sod. Tart., Rochelle Salt, Tartarated Soda, Natrokali Tartaricum, Soda Tartarata, Sal Polychrestum Seignetti, Tartras Potassico-sodicus; Fr. Sel de Seignette, Soude Tartarisée; Ger. Tartras natronatus, Kaliumnatriumtartrat, Seignettesalz.)

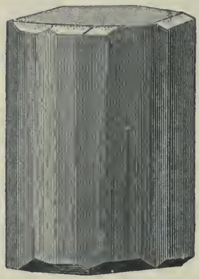


FIG. 444. — Rochelle salt crystal.

Manufacture: Add potassium bitartrate to hot solution of sodium carbonate, to neutralize free acid, thus obtaining normal double tartrate—$2KHC_4H_4O_6+(Na_2CO_3+10H_2O)=2(KNaC_4H_4O_6,\text{-}4H_2O) + CO_2 + 3H_2O$; practically 8 parts potassium bitartrate + 6 sodium carbonate crystals yield 12 crystallized Rochelle salt. It is in colorless, transparent, rhombic prisms, or white powder, odorless, cooling saline taste, crystals slightly efflorescent in dry air, soluble in water (.9), almost insoluble in alcohol; aqueous solution (1 in 20) alkaline to litmus, not reddened by a drop of phenolphthalein T. S.; contains 73.72–77.39 p. c. of anhydrous potassium and sodium tartrate, corresponding to 99 p. c. of crystallized salt. *Tests:* 1. Heat to 74° C. (165° F.)—fuses to colorless liquid, which at higher heat froths, becomes brown, gradually carbonizes, emitting inflammable vapors of burning-sugar odor, residue consisting of potassium and sodium carbonates with carbon, imparting intensely yellow flame. 2. Aqueous solution (1 in 10) with acetic acid—white, crystalline precipitate; with silver nitrate T. S.—white precipitate, black on boiling. *Impurities:* Heavy metals, lead, ammonia, etc. Should be kept in well-closed containers. Dose, aperient, ʒij–4 (8–15 Gm.); hydragogue cathartic, ℥j (30 Gm.).

PREPARATION.—1. *Pulvis Effervescens Compositus.* Compound Effervescing Powder. (Syn., Pulv. Eff. Co., Seidlitz Powder, Pulveres Effervescentes Aperientes; Br. Pulvis Sodæ Tartaratæ Effervescens, Effervescent Tartarated Soda Powder; Fr. Poudre gazifère purgative, Poudre de Seidlitz; Ger. Pulvis aërophorus, Laxans or Seidlitzensis, Brausepulver Abführendes, Seidlitzpulver.)

Manufacture: Mix thoroughly sodium bicarbonate gr. 38.5 (2.5 Gm.) with potassium and sodium tartrate gr. 115.5 (7.5 Gm.), wrap in blue paper; then wrap in white paper tartaric acid gr. 33.5 (2.2 Gm.); contains (blue paper) 9.5–10.5 Gm.; 23–27 p. c. of sodium bicarbonate, 73–78 p. c. of potassium and sodium tartrate. *Test:* 1. Aqueous solution of blue paper contents (1 in 20) and acetic acid, each 5 Ml. (Cc.), after effervescence shake vigorously—white, crystalline precipitate, soluble in ammonia water. Should be kept dry, in well-closed containers. Dose, 1 powder; dissolve contents of the blue paper in a half-glass of water (ordinary temperature), and to this add contents of the white paper—drink while effervescing.

PROPERTIES.—Cream of tartar, Rochelle salt, and Seidlitz powders are all diuretic, purgative, refrigerant, antilithic.

Uses.—Febrile diseases, dropsy, hemorrhoids, vomiting from gastric acidity and pregnancy. Cream of tartar is believed to be eliminated from the system unchanged, hence not so good when alkalinity desired for blood and urine. Small and frequent doses of Rochelle salt simply make urine alkaline.

Potassii Chloras. Potassium Chlorate, $KClO_3$.—(Syn., Pot. Chloras, Kali Oxymuriaticum, Kali Muriaticum Oxygenatum, Chloras (Potassicus) Kalicus, Hyperoxymuriate of Potassa; Fr. Chlorate de Potasse; Ger. Kalium chloricum, Kaliumchlorat, Chlorsaures Kali.)

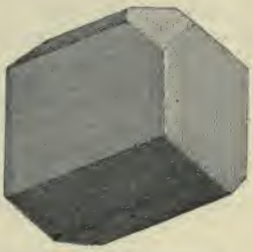


FIG. 445.—Potassium chlorate crystal.

Manufacture: Pass chlorine into water holding lime (preferably magnesium oxide) in suspension, thereby forming chloride and hypochlorite, the latter by heat being converted into chlorate and chloride, treat solution with potassium chloride, giving potassium chlorate which crystallizes out, and potassium (magnesium) chloride that remains in solution; magnesium is preferred, as potassium chlorate is less soluble in solution of magnesium chloride than of calcium chloride—$2Ca(OH)_2+Cl_4=Ca(ClO)_2+CaCl_2+2H_2O$; $3Ca(ClO)_2 = Ca(ClO_3)_2 + 2CaCl_2$; $Ca(ClO_3)_2 + 2KCl = 2KClO_3 + CaCl_2$. May also be made by passing electric current into solution potassium chloride. It is in colorless, lustrous, monoclinic prisms, plates, or white granular powder, odorless, saline taste, permanent, soluble in glycerin, water (11.5), boiling water (1.8), almost insoluble in alcohol; aqueous solution (1 in 20) neutral; contains 99 p. c. of pure salt. *Tests:* 1. When heated—melts giving off oxygen, leaving residue of potassium chloride, readily soluble in water, and yielding with silver nitrate T. S. a white precipitate, insoluble in nitric acid, soluble in ammonia water; imparts violet flame; add .2 Gm. to hydrochloric acid 1 Ml. (Cc.)—deep greenish-yellow color, chlorine evolved. 2. Aqueous solution (1 in 20) with excess of tartaric acid T. S.—scant, white, crystalline precipitate (slowly); with platinic chloride T. S.—yellow crystalline precipitate. *Impurities:* Heavy metals, etc. Should be kept in well-closed containers, and handled cautiously, as dangerous explosions may occur if heated, subjected to concussion or triturated with organic substances (cork, tannin, dust, sugar, sulphur, antimony sulphide (sulphides), phosphorus, hypophosphites, catechu, glycerin, etc. Dose, gr. 5–20 (.3–1.3 Gm.).

Preparations.—1. *Trochisci Potassii Chloratis.* Troches of Potassium Chlorate. (Syn., Troch. Pot. Chlorat.; Br. Trochiscus Potassii Chloratis; Fr. Tablettes (Pastilles) de Chlorate de Potasse; Ger. Pastillen von Chlorsaurem Kali, Kaliumchloratpastillen.)

Manufacture: Triturate together sugar 60 Gm., tragacanth 3 Gm., transfer to a sheet of paper and, by means of a bone or wooden spatula, mix with potassium chlorate 15 Gm., avoiding hard trituration or pressure that might cause ignition or explosion, form mass with water q. s., divide into 100 troches. Dose, 1–4 troches.

Properties.—Alterative, stimulant, oxidizant, irritant, diuretic, poisonous; converts hæmoglobin into methæmoglobin, disintegrates red corpuscles.

Uses.—Mercurial salivation and ulcers of the mouth, ulcerated stomatitis, aphthæ, buccal and pharyngeal diphtheria, hemorrhoids, thrush, croup, ozæna, fetid breath, dysentery, vaginitis, cystitis. Internally in scrofula, scarlatina, typhoid fever, cardiac cyanosis, dropsy, blood-poisoning, malignant fevers. Mostly excreted by the kidneys unchanged.

Poisoning: Excessive quantities (ʒij–4; 8–15 Gm.) produce vomiting, diarrhœa, dyspnœa, heart-failure, cyanosis, nervous disturbance, jaundiced skin, delirium, coma, acute nephritis, death. Induce vomiting and give abundant water, mucilaginous drinks to dilute, opium for pain, amyl nitrite, keep loins warm, avoid renal stimulants.

Potassii Hypophosphis. Potassium Hypophosphite, KH_2PO_2.—(Syn., Pot. Hyphophos., Kalium Hypophosphorosum, Hypophosphis (Potassicus) Kalicus; Fr. Hypophosphite de Potasse; Ger. Unterphosphorigsaures Kali.)

Manufacture: Mix solutions of potassium carbonate and calcium hypophosphite, getting double decomposition—$Ca(H_2PO_2)_2 + K_2CO_3 = 2KH_2PO_2 + CaCO_3$, filter from the calcium carbonate, evaporate, granulate. It occurs in white, opaque, hexagonal plates, crystalline masses, or granular powder, odorless, pungent, saline taste, very deliquescent, soluble in water (.6), boiling water (.4), alcohol (9), boiling alcohol (5); aqueous solution (1 in 20) neutral, slightly alkaline; with sodium bitartrate T. S.—white, crystalline precipitate; contains, when dried, 98 p. c. of pure salt. *Tests:* 1. Heat in dry test-tube—spontaneously inflammable hydrogen phosphide which burns with bright yellow flame. 2. Add aqueous solution (1 in 20), acidulated with hydrochloric acid, drop by drop with agitation, to excess of mercuric chloride T. S.—white precipitate of mercurous chloride; now add solution of potassium hypophosphite—precipitate becomes gray from reduction to metallic mercury. *Impurities:* Arsenic, phosphates. Should be kept dry, in well-closed containers, and dispensed with caution, as explosion may occur when triturated or heated with nitrates, chlorates, or other oxidizing agents. Dose, gr. 5–30 (.3–2 Gm.).

Preparations.—1. *Syrupus Hypophosphitum.* Syrup of Hypophosphites. (Syn., Syr. Hypophos., Syrupus Calcii Hypophosphitis Compositus; Fr. Sirop d'Hypophosphite de Chaux composé; Ger. Hypophosphitsirup.)

Manufacture: Triturate calcium hypophosphite 4.5 Gm., potassium hypophosphite 1.5 Gm., sodium hypophosphite 1.5 Gm., with distilled water 50 Ml. (Cc.) until dissolved, add diluted hypophosphorous acid .2 Ml. (Cc.), filter, pass through filter distilled water q. s. 54 Ml.

(Cc.), add glycerin 5 Ml. (Cc.), sugar 60 Gm., dissolve by agitation, add through filter distilled water q. s. 100 Ml. (Cc.), strain. Dose, ʒj–2 (4–8 Ml. (Cc.)).

Unoff. Prep.: Syrupus Hypophosphitum Compositum, official 1900–1910 (rub ferric hypophosphite 2.25 Gm., manganese hypophosphite 2.25 Gm. with sodium citrate 3.75 Gm., add water 30 Ml. (Cc.), heat gently until solution clear, green; dissolve hypophosphites of calcium 35 Gm., potassium 17.5 Gm., sodium 17.5 Gm., in water 450 Ml. (Cc.) + diluted hypophosphorous acid 5 Ml. (Cc.); dissolve quinine 1.1 Gm., strychnine .115 Gm. in water 30 Ml. (Cc.) + glycerin 50 Ml. (Cc.), and 10 Ml. (Cc.) diluted hypophosphorous acid, mix solutions, and in them dissolve sugar 700 Gm., by agitation, strain, add water, q. s. 1,000 Ml. (Cc.). Dose, ʒj–2 (4–8 Ml. (Cc.)).

Properties and Uses.—Potassium hypophosphite is believed to be of great advantage owing to the phosphorus. Used in phthisis, depleted nerve-power, scrofulous affections, chronic bronchitis, coughs (expectorant).

Potassii Bromidum. Potassium Bromide, KBr.—(Syn., Pot. Brom., Bromuretum (Potassicum) Kalicum; Fr. Bromure de Potassium; Ger. Kalium bromatum, Kaliumbromid, Bromkalium.)

Manufacture: Add bromine to solution potassium hydroxide until liquid remains colored, thereby producing bromide and bromate, evaporate to dryness, mix with charcoal, heat to redness, thus converting all of the bromate into bromide—(1) $6KOH + 6Br = 5KBr + KBrO_3 + 3H_2O$. (2) $2KBrO_3 + 6C = 2KBr + 6CO$. The KBr is dissolved out of the mass with water, and solution allowed to crystallize. The salt may also be made by decomposing bromide of iron with potassium carbonate—$K_2CO_3 + FeBr_2 = 2KBr + FeCO_3$. The iron carbonate is precipitated, while potassium bromide remains in solution. It is in colorless or white cubical crystals or granular powder, odorless, strongly saline taste, permanent, soluble in water (1.5), boiling water (1), alcohol (250), boiling alcohol (21), glycerin (4.6); aqueous solution (1 in 20) neutral or faintly alkaline; contains 98.5 p. c. of pure salt. *Tests:* 1. Heat upon platinum foil—decrepitates; at higher temperature fuses without decomposition, at bright red volatilizes with violet flame. 2. Aqueous solution (1 in 5) and sodium bitartrate T. S. each 5 Ml. (Cc.)—white, crystalline precipitate; with silver nitrate T. S. —yellowish-white precipitate, insoluble in nitric acid or ammonia water. *Impurities:* Heavy metals, barium, alkalies, bromate, iodide, sulphate. Should be kept in well-closed containers. Dose, gr. 10–60 (.6–4 Gm.), ter die, in water, elixir, syrup. In strychnine-poisoning give ʒiij–4 (12–15 Gm.) at once; in tetanus the same amount within 24 hours.

Preparations.—(Unoff.): *Sal Potassii Bromidi Effervescens*, 16.6 p. c. *Sal Potassii Bromidi Effervescens Compositus*, 8.3 p. c. + caffeine .8, lithium carbonate 4.2, +. *Elixir Potassii Bromidi*, 17.5 p. c., dose, ʒij–4 (8–15 Ml. (Cc.)).

PROPERTIES.—Sedative, hypnotic, anæsthetic, narcotic, antiseptic, anaphrodisiac. All bromides in the stomach and intestines are converted quickly into sodium bromide, and as such are absorbed. Large doses lessen force and frequency of heart-beat, causing a stoppage in diastole. Eliminated by kidneys, skin, intestinal and bronchial mucous membranes, in saliva, milk.

USES.—Epilepsy, hysterical, infantile, and puerperal convulsions, neuralgia, insanity, delirium tremens, chorea, tetanus, sunstroke, hysteria, whooping-cough, spasmodic asthma, vomiting of phthisis, seasickness, nervousness, angina pectoris, diabetes, seminal emissions, priapism, incontinence of urine, in teething, toothache, urticaria, acne, intermittent fever, enlarged spleen, amblyopia, diphtheria, to anæsthetize the pharynx, larynx, urethra, irritable bladder, enlarged prostate, gangrenous sores, strychnine-poisoning. After prolonged use may have *bromism,* which consists of muscular weakness, mental and bodily sluggishness, loss of memory, stupidness, depressed spirits, apathy, low temperature, with patient recumbent in bed, prostrated and almost lifeless; fetid breath, coated tongue, and acneiform eruption are its first constitutional symptoms, which may largely be aborted by Fowler's solution ♏j–5 (.06–.3 Ml. (Cc.)) with each dose of bromide.

Poisoning: Withdraw drug, give diuretics, cathartics, tonics, iron, strychnine, cardiac stimulants, strong coffee, caffeine citrate, digitalis, morphine (best antagonist to mental symptoms), ergot, atropine.

Incompatibles: Motor excitants, cardiac stimulants, acids, acidulous and metallic salts.

Synergists: Opium, hypnotics, cardiac depressants.

Potassii Iodidum. Potassium Iodide, KI.—(Syn., Pot. Iod., Kali Hydriodicum, Ioduretum (Potassicum) Kalicum; Fr. Iodure de Potassium; Ger. Kalium jodatum, Kaliumjodid, Jodkalium.)

Manufacture: Add iodine to hot solution potassium hydroxide until dark brown color is permanent, thus producing iodide and iodate; this solution is evaporated to dryness, mixed with charcoal, and heated to redness, in order to convert all iodate into the iodide—(1) $6KOH + 6I = 5KI + KIO_3 + 3H_2O$. (2) $2KIO_3 + 6C = 2KI + 6CO$. The KI is dissolved out of the mass with boiling water, and solution set aside to crystallize; may also be prepared by action of ferrous iodide and potassium carbonate, or from the mother-liquors of Chile saltpetre. It is in colorless, transparent, translucent, or opaque, white, cubical crystals, or white, granular powder, pungent, saline, bitter taste, permanent, slightly deliquescent, soluble in water (.7), boiling water (.5), alcohol (22), boiling alcohol (8), glycerin (2); aqueous solution (1 in 20) neutral, slightly alkaline; contains, when dried, 99 p. c. of pure salt. *Tests:* 1. When heated—decrepitates; at low red heat—fuses; at bright red heat—volatilizes without decomposition. 2. Aqueous solution (1 in 20) and sodium bitartrate T. S. each 5 Ml. (Cc.)—white, crystalline precipitate; with 1 Ml. (Cc.) of ferric chloride

T. S. + distilled water 1 Ml. (Cc.), shake with chloroform 5 Ml. (Cc.)—latter violet color. *Impurities:* Heavy metals, barium, alkalies, cyanide, iodate, thiosulphate. Should be kept in well-closed containers. Dose, gr. 2–30 (.13–2 Gm.), ter die, largely diluted; in syphilis may give ʒij–4 (8–15 Gm.) daily, well diluted with water, milk, compound syrup of sarsaparilla.

Preparations.—1. *Acidum Hydriodicum Dilutum.* Diluted Hydriodic Acid, HI. (Syn., Acid. Hydriod. Dil.; Fr. Acide hydriodique dilué; Ger. Verdünnte Jodwasserstoffsäure.) An aqueous solution containing 9.5–10.5 p. c. of HI.

Manufacture: Dissolve with heat potassium iodide 13.5 Gm., potassium hypophosphite 1 Gm. in distilled water 25 Ml. (Cc.); dissolve tartaric acid 13.65 Gm. in diluted alcohol 40 Ml. (Cc.), pour into a bottle and add first solution, shake mixture briskly and cool several hours (ice water 5° C.; 41° F.), filter, wash precipitate with diluted alcohol until 100 Gm. of clear solution obtained, evaporate off alcohol (water-bath), add distilled water q. s. 100 Gm.—$KI + KH_2PO_2 + 2H_2C_4H_4O_6 = HI + HH_2PO_2 + 2KHC_4H_4O_6$; here are formed hydriodic and hypophosphorous acids, and acid potassium tartrate, the removal of the latter being facilitated by alcohol and cold; potassium hypophosphite preserves acid solution, as its contained hypophosphorous acid (.63 p. c.) reconverts any free iodine that might possibly be liberated. It is a colorless, pale yellow, odorless liquid; strongly acid taste and reaction; sp. gr. 1.100. *Tests:* 1. Add distilled water (2), + few drops of ferric chloride T. S. or chlorine water—liberates iodine, reddish-brown solution. 2. Agitate preceding mixture with chloroform (few drops)—latter becomes violet. *Impurities:* Heavy metals, arsenic, barium, free iodine, chloride, sulphuric acid. Should be kept dark, in amber-colored, glass-stoppered bottles, and not dispensed if containing free iodine. Absolute hydriodic acid is a colorless, irrespirable, non-inflammable gas, sp. gr. 4.440, having odor of hydrochloric acid, strongest solution obtainable being 57.75 p. c. Dose, ♏v–30 (.3–2 Ml. (Cc.)).

Prep.: 1. *Syrupus Acidi Hydriodici.* Syrup of Hydriodic Acid.—(Syn., Syr. Acid. Hydriod.; Fr. Sirop d'Acide iodhydrique; Ger. Jodwasserstoffsirup.)

Manufacture: 1.38 p. c. Mix diluted hydriodic acid 12.5 Ml. (Cc.), distilled water 30 Ml. (Cc.), syrup 57.5 Ml. (Cc.); the 100 Ml. (Cc.) contain 1.3–1.45 Gm. of pure acid. It is a transparent, colorless, pale straw-colored, syrupy liquid, odorless, sweet, acidulous taste, sp. gr. 1.215. *Impurities:* Free iodine, etc. Dose, ʒj–2 (4–8 Ml. (Cc.)).

2. *Liquor Iodi Compositus,* 10 p. c. 3. *Tinctura Iodi,* 5 p. c. 4. *Unguentum Iodi,* 4 p. c.

Unoff. Prep.: Unguentum Potassii Iodidi, 10 p. c., + sodium thiosulphate 1, water 9, benzoinated lard 80. *Linimentum Potassii Iodidi cum Sapone* (Br.), 10 p. c.

Properties.—Alterative, stimulant, absorbent, irritant.

USES.—Specific in rheumatism, nervous diseases, secondary and tertiary syphilis, mercurial tremors and sore mouth, lead-poisoning and palsy, aneurism of the aorta, dropsy, granular meningitis, chronic hydrocephalus, brain tumors, priapism, muscular rheumatism, sciatica, angina pectoris, heart diseases, gout, pneumonia, chronic bronchitis, asthma, paralysis, cord sclerosis. Hydriodic Acid and Syrup—similar to iodine and iodides, but less offensive to stomach and taste; chiefly as alterative in scrofula, chronic bronchitis, malarial poisoning, etc. All preparations and compounds containing iodine, iodide of potassium, etc., when given in large repeated doses produce constitutional symptoms known as *iodism*, preceded by coryza and pain over the brow, sore throat, fetid breath, swollen gums, eruptive acne, neuralgia, emaciation, cardiac palpitation.

Poisoning, Incompatibles: Same as for iodine, see page 683.

Potassii Nitras. Potassium Nitrate, KNO_3.—(Syn., Pot. Nitras, Saltpetre, Nitre, Nitras (Potassicus) Kalicus, Sal (Petræ) Nitri, Nitrum Depuratum; Fr. Azotate (Nitrate) de Potasse, Nitre prismatique; Ger. Kalium nitricum, Kaliumnitrat, Salpetersaures Kali, Kalisalpeter.)

Manufacture: While this may be made by neutralizing nitric acid with potassium carbonate, yet by far the greater part of that used is found as a neutral salt in Chile, Peru, India, etc. Some of this supply, however, is a product of nitre beds, which consist of a mechanical mixture of animal refuse, earth, and lime, protected under cover. By putrefaction ammonia is formed, which, upon oxidation, becomes nitric acid and unites with the calcium; this is dissolved out and decomposed with potassium carbonate or chloride—$Ca(NO_3)_2 + K_2CO_3 = 2KNO_3 + CaCO_3$. Saltpetre may also be obtained from Chile saltpetre by double decomposition—$NaNO_3 + KCl = KNO_3 + NaCl$. It is colorless, transparent, 6-sided, rhombic prisms, or white crystalline powder, odorless, saline taste, with cooling sensation in the mouth, slightly hygroscopic, soluble in glycerin, water (2.8), boiling water (.5), alcohol (620); aqueous solution (1 in 10) neutral; contains, when dried, 99 p. c. of pure salt. *Tests:* 1. Heat strongly—melts without decomposition; at higher heat—evolves oxygen, partly reduced to nitrite; heated with charcoal—deflagrates. 2. Aqueous solution (1 in 20) with sodium bitartrate T. S.—white crystalline precipitate; aqueous solution (1 in 10) with 1 drop of diphenylamine T. S. + sulphuric acid slowly added to form separate layer—deep blue at line of contact. *Impurities:* Heavy metals, chlorate, perchlorate. Should be kept in well-closed containers. Dose, gr. 10–30 (.6–2 Gm.).

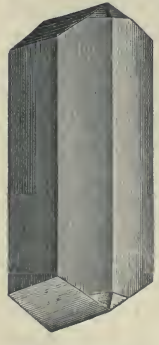


FIG. 446.—Potassium nitrate crystal.

PREPARATION.—(Unoff.): *Charta Potassii Nitratis*, official 1880–1900; potassium nitrate 20, water 80; immerse in solution strips of white, unsized paper, dry, keep in well-closed containers.

Properties.—Refrigerant, diuretic, diaphoretic, antiseptic, purgative, nervous sedative, cardiac depressant (causing fewer and feebler beats), irritant, alterative; enters blood unchanged; eliminated by kidneys unchanged.

Uses.—Acute rheumatism, pneumonia, fevers (acetate and citrate preferable), dropsy, stomatitis, bronchitis, freckles, bruises, abrasions, scurvy, angina, asthma, gout, gonorrhœa, incontinence of urine, manufacture of gunpowder. The once official charta mostly burnt for asthma.

Potassii Permanganas. Potassium Permanganate, $KMnO_4$.—(Syn., Pot. Permang., Hypermanganas (Potassicus) Kalicus; Fr. Permanganate de Potasse; Ger. Kalium permanganicum, Kaliumpermanganat, Uebermangansaures Kali.)

Manufacture: Fuse manganese dioxide with potassium carbonate (or hydroxide) and potassium chlorate (or nitrate). The manganese is converted into manganic acid, which, combining with the alkali, forms potassium manganate; this can be dissolved out by water, giving a dark emerald-green solution, and crystallized. If this solution now be acidified (H_2SO_4) or boiled with much water, it becomes red and contains in solution $KMnO_4$ and a precipitate of MnO_2—(1) $3MnO_2 + 3K_2CO_3 + KClO_3 = 3K_2MnO_4 + KCl + 3CO_2$. (2) $3K_2MnO_4 + 2H_2SO_4 = 2KMnO_4 + 2K_2SO_4 + MnO_2 + 2H_2O$, or $3K_2MnO_4 + 2H_2O = 2KMnO_4 + MnO_2 + 4KOH$. It is in slender, monoclinic prisms, dark purple color, almost opaque by transmitted light, blue metallic lustre by reflected light, odorless, sweet, disagreeable, astringent taste (in solution), permanent, soluble in water (13.5), boiling water (3.5), decomposed by alcohol; when heated decrepitates; at 240° C. (464° F.) decomposes, yielding oxygen, potassium manganate, and manganese dioxide; contains, when dried, 99 p. c. of pure salt. *Tests:* 1. Aqueous solution, rose to deep violet-red, has color discharged by hydrogen sulphide, ferrous sulphate, oxalic acid, alcohol, etc., especially if acidified by sulphuric acid. Should be kept in glass-stoppered bottles, and when dry or in solution must not be brought in contact with organic or other readily oxidizable substances. Dose, gr. 2–5 (.13–.3 Gm.), given on a full stomach in much water, or pill made with kaolin, soft paraffin, or wool fat.

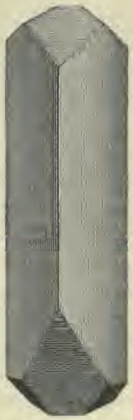


Fig. 447.—Potassium permanganate crystal.

Preparation.—(Unoff.): *Liquor Potassii Permanganatis* (Br.), 1 p. c. Dose, ʒij–4 (8–15 Ml. (Cc.)).

Properties.—Disinfectant, deodorant, antiseptic, caustic, stimulant, emmenagogue; liberates much of its oxygen as ozone.

Uses.—Externally—fetid and gangrenous ulcers, wounds, abscesses, carbuncles, gonorrhœa, leucorrhœa, otorrhœa, diphtheria, cancerous ulcers, eczema. Internally—diphtheria, scarlatina, atonic amenorrhœa, antidote to morphine, opium (by mouth; of little value by rectum, and still less hypodermically), phosphorus, serpents' bites and rabies poisoning. The stains can be resolved by weak acid solutions (oxalic, hydrochloric), lemon juice, etc. It oxidizes to the extent of its available oxygen, forming harmless compounds.

Acidum Hydrocyanicum Dilutum. Diluted Hydrocyanic Acid, HCN.—(Syn., Acid. Hydrocyan. Dil., Diluted Prussic Acid, Acidum Hydrocyanatum (Borussicum), Cyanhydric Acid; Fr. Acide cyanhydrique (hydrocyanique); Ger. Cyanwasserstoffsäure, Blausäure.) An aqueous solution containing 1.9–2.1 p. c. of HCN, and not more than .1 p. c. of HCl.

Manufacture: 1. *Extemporaneously.*—Mix diluted hydrochloric acid 15.54 Ml. (Cc.) with distilled water 44.10 Ml. (Cc.), add silver cyanide 6 Gm., shake, reject the precipitate—$AgCN + HCl = HCN + AgCl$. 2. *Commercially.*—Heat potassium ferrocyanide 20 Gm. + sulphuric acid 8 Ml. (Cc.) + water 65 Ml. (Cc.), pass evolved gas into distilled water 65 Ml. (Cc.). It is a colorless liquid; characteristic odor (resembling bitter almond); acid reaction, volatile, very unstable and poisonous; use care in handling and tasting. *Tests:* 1. Render 1 Ml. (Cc.) alkaline with potassium hydroxide T. S., + few drops of ferrous sulphate T. S., boil, acidulate with hydrochloric acid—blue precipitate. 2. Evaporate 10 Ml. (Cc.)—residue .002 Gm. *Impurities:* Hydrogen chloride, etc. Should be kept in small, dark amber-colored, well-stoppered vials. Dose, ♏j–3 (.06–.2 Ml. (Cc.)), in water or alcohol. An acid of 5 p. c. is manufactured, but it is even less stable and reliable than the official.

Properties.—Hydrocyanic acid and all cyanides: Anæsthetic, sedative, anodyne, antispasmodic. On unbroken skin, mouth, and stomach paralyzes sensory nerve-endings; small doses slow the heart by stimulating inhibitory centres; large doses may cause diastolic arrest (instantaneous death) by paralyzing the heart directly, and cardiac centre in the medulla. Quickly enters blood, causing all to be bright red (arterial tint), then going to dark venous color. The venous becomes red, owing to its hæmoglobin being oxidized; the arterial becomes dark, owing to its oxygen being replaced by carbon dioxide; may produce dermatitis.

Uses.—Phthisis, dyspnœa, cough, asthma, whooping-cough, chronic catarrh, nervous cough, angina pectoris, gastralgia, skin diseases.

Poisoning: Symptoms established within a half to two minutes—giddiness, stupor, complete insensibility, eyes fixed, glistening, pupils dilated, dyspnœa, limbs flaccid, skin cold, clammy, respiration slow, deep, convulsive, pulse weak, slow, almost imperceptible, convulsions, paralyzed spine, death from asphyxia (from paralysis of respiratory centre), breath has bitter almond odor. If possible, wash out stomach, emetics, atropine hypodermically, gr. $\frac{1}{50}$ (.0013 Gm.), ether, brandy, ammonia inhalations, chlorine water, artificial respirations and heat, cold water alternately on chest and spine, electricity; ferrous and ferric sulphates, followed by K_2CO_3 solution = insoluble Prussian blue (antidote). Rapidly eliminated by lungs and kidneys.

Incompatibles: Atropine, diffusible stimulants; copper, iron, and silver salts, cobalt nitrate, red mercuric oxide and sulphide.

Synergists: Cardiac and motor depressants.

Allied Salts:

1. *Potassii Cyanidum. Potassium Cyanide,* KCN, official 1820–1910.—Obtained by passing hydrocyanic acid gas (potassium ferrocyanide (2) + sulphuric acid q. s.) into solution of potassium hydroxide in alcohol (1 in 5–6), washing precipitate with alcohol, or heat together potassium carbonate and potassium ferrocyanide—$K_2CO_3 + K_4Fe(CN)_6 = 5KCN + KCNO + Fe + CO_2$. May remove cyanate with alcohol or carbon disulphide, and, as the iron is precipitated to the bottom of iron retort, must, in pouring out the mass, stop short of any iron contamination. It is in white, opaque, amorphous pieces, white granular powder, without odor (dry), or of hydrocyanic acid (moist), sharp alkaline taste, deliquescent, soluble in water (2), sparingly in alcohol; contains 95 p. c. of pure salt. *Impurities:* Carbonate (HCl), ferrocyanide (Fe_2Cl_6, blue), sulphocyanates (Fe_2Cl_6, red); should be kept in well-stoppered bottles labelled poison, and handled with great care. Sedative, antispasmodic, anodyne—similar to hydrocyanic acid as poison and medicine; headache from dyspepsia, menstruation, etc. Dose, gr. $\frac{1}{16}$–$\frac{1}{8}$ (.004–.008 Gm.), in water.

2. *Potassii Ferrocyanidum. Potassium Ferrocyanide,* $K_4Fe(CN)_6 + 3H_2O$, official 1820–1910.—Obtained by heating together potassium carbonate (pearl-ash), nitrogenous animal refuse (dried blood, hoofs, etc.), and iron scraps; the fused mass (melt) is lixiviated and this solution evaporated for crystallization—(1) $6KCN + Fe + 2H_2O = K_4Fe(CN)_6 + 2KOH + H_2$, or (2) $6KCN + FeS = K_4Fe(CN)_6 + K_2S$. Now very largely obtained from the mass of ferric hydroxide used to purify illuminating gas, as that absorbs cyanogen compounds forming ferrocyanides, etc. It is in large, soft, transparent, yellow, 4-sided, monoclinic tabular crystals or prisms, odorless, mild saline taste, soluble in water (4), insoluble in alcohol, efflorescent; contains 99 p. c. of pure salt. *Impurities:* Carbonate, ferricyanide. Not used much medicinally, although it is non-poisonous when pure; sometimes valuable in checking colliquative sweats of phthisis; important test reagent for copper, zinc, and ferric salts; chief source of cyanogen compounds.

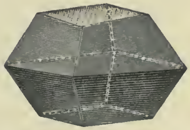


FIG. 448. — Potassium ferrocyanide crystal.

3. *Potassii Carbonas Impura. Impure Carbonate of Potassium,* official 1830–1860 (pearl-ashes, pearl-ash).—This is simply the crude potash salts, black salts, derived from the evaporated lye of wood-ashes, subjected to direct flame in an oven-shaped furnace. By this means all combustible impurities are burnt out, and the mass, from

being black, becomes of a bluish-white color. It is still official in Germany as Kalium carbonicum crudum, Pottasche.

4. *Potassii Dichromas. Potassium Dichromate,* $K_2Cr_2O_7$, official 1860–1910.—Obtained by heating together potassium carbonate, lime, and powdered chrome iron ore which has previously been roasted; the iron is oxidized into ferric oxide, and chromium into chromic acid; this latter attacks the potassium carbonate forming the neutral chromate, which is treated with an acid (H_2SO_4 or HNO_3) to get the acid or bichromate—(1) $2FeOCr_2O_3 + 4K_2CO_3 + O_7 = Fe_2O_3 + 4CO_2 + 4K_2CrO_4$. (2) $2K_2CrO_4 + H_2SO_4 = K_2Cr_2O_7 + K_2SO_4 + H_2O$. It occurs in large, orange-red, transparent, triclinic prisms, or 4-sided tabular crystals, odorless, acidulous metallic taste, soluble in water (9), insoluble in alcohol, permanent; contains 99 p. c. of pure salt. *Tests:* 1. At white heat evolves oxygen, leaving neutral potassium chromate and green chromic oxide. 2. Sodium cobaltic nitrate T. S.—yellow precipitate. Irritant, caustic, alterative, expectorant; secondary syphilis; externally—caustic in tubercular enlargements, excrescences, warts, syphilitic sores, sloughing wounds; largely in calico-printing, pigments, etc.; employees in its manufacture often suffer from ulcers on hands, face, nares, etc., from the irritating fumes. *Poisoning:* Have a violent irritative, corrosive condition; vomiting, hemorrhagic dejections, abdominal pains, dilated pupils, great depression, collapse, poor circulation, coma, heart failure, death. Give emetic, alkaline carbonate (bicarbonate), or magnesium oxide, chalk, demulcent drinks, milk, egg-white, stimulants, heat, opium. Should be kept in well-stoppered containers. Dose, gr. $\frac{1}{5}$ (.0013 Gm.), in pill.

FIG. 449.—Potassium dichromate crystal.

5. *Potassii Sulphas. Potassium Sulphate,* K_2SO_4, official 1820–1910. — Obtained by decomposing potassium carbonate, nitrate, or chloride with sulphuric acid, or by neutralizing sulphuric acid with potassium hydroxide, or from kainite, but its greatest source is as a by-product in the manufacture of nitric acid — (1) $K_2CO_3 + H_2SO_4 = K_2SO_4 + H_2O + CO_2$. (2) $2KCl + H_2SO_4 = 2HCl + K_2SO_4$. (3) $2KNO_3 + H_2SO_4 = K_2SO_4 + 2HNO_3$. (4) $KNO_3 + H_2SO_4 = KHSO_4 + HNO_3$. In this last formula the acid sulphate has to be converted into normal sulphate—$2KHSO_4 + K_2CO_3 = 2K_2SO_4 + CO_2 + H_2O$. It is in hard, colorless, transparent, 6-sided, rhombic prisms, terminated by pyramids, or in a white powder, odorless, bitter, saline taste, permanent; soluble in water (9), insoluble in alcohol; contains 99 p. c. of pure salt. *Impurities:* Heavy metals, arsenic. Mild purgative, cholagogue, operating usually without pain, heat, or perceptible

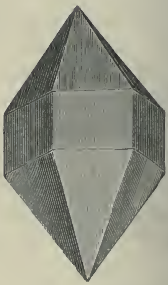


FIG. 450.—Potassium sulphate crystal.

irritation; given after labor and for drying up mammary secretion, dyspepsia, biliousness, albuminuria. Owing to hardness, it is used for pulverizing tough vegetable substances, like ipecac, etc. Usually prescribed with rhubarb, etc. Dose, ʒss–4 (2–15 Gm.).

6. *Potassii Sulphis. Potassium Sulphite,* $K_2SO_3.2H_2O$, official 1870–1890.—Obtained by passing SO_2 through solution of K_2CO_3 until the CO_2 is expelled, then adding equal weight of K_2CO_3, after which sulphite crystallizes out. It is in opaque octahedral crystals or crystalline powder, odorless, deliquescent, bitter, saline, sulphurous taste; used like sulphites of sodium and magnesium, to which it is inferior. Dose, as a laxative, ʒij–4 (8–15 Gm.).

7. *Potassii Tartras. Potassium Tartrate,* $K_2C_4H_4O_6,H_2O$, official 1880–1890.—Obtained by gradually adding to a solution of potassium carbonate (preferably bicarbonate) acid tartrate of potassium until neutral, filtering, concentrating, setting aside to crystallize—$2KHC_4H_4O_6 + K_2CO_3 = 2K_2C_4H_4O_6,H_2O + CO_2$. Diuretic, purgative, aperient; more gentle than sodium or magnesium sulphate; hepatic and portal congestion, hemorrhoidal swellings, febrile diseases. Dose, ʒj–8 (4–30 Gm.).

8. *Potassii Chloridum. Potassium Chloride,* KCl.—Obtained at Stassfurt from *carnallite,* double chloride of potassium and magnesium. In colorless, elongated crystals, granular powder, odorless, saline. Employed largely in manufacturing potassium salts.

SODIUM (NATRIUM).

$Na^i = 23.$

The metallic element sodium (L. *sod-a,* + *ium,* fr. *solidus,* contr. *sodo,* solid, hard, *sod-ash,* residue from burning masses or *sods* of marine plants) is not itself official, but many of its salts are. It is diffused widely in nature in the form of various compounds, occurring in the atmosphere, soil, spring- and sea-waters, rock and common salt, mainly as the chloride; there is also the native nitrate and silicate, all being more abundant and soluble than potassium salts, and, like them, dissolved by rain-water, which, in its onward movement, dissolves and deposits some of them almost everywhere. The metal is obtained similarly to potassium (heating carbonate with carbon, etc.), with which it is distributed universally.

Tests for Sodium Salts.—1. Sodium salts are all soluble in water, consequently cannot be precipitated by any reagent. 2. The main test is that all compounds impart a yellow color to a colorless Bunsen flame, and the spectroscope gives a characteristic yellow line. 3. Sodium compounds are white, soluble in water, and non-volatile at a red heat.

Sodii Boras. Sodium Borate, $Na_2B_4O_7 + 10H_2O$.—(Syn., Sod. Bor., Borax, Sodium Tetraborate (Pyroborate), Sodæ Biboras, Sodium Biborate, Natrium Biboricum (Biboracicum), Boras Sodicus; Fr.

Borate de Soude, Sel de Perse; Ger. Borsaures Natron, Natrium (pyroborat)-borat.)

Manufacture: This salt, natively called tincal, is found in Thibet, Persia, California, etc., occurring as a saline incrustation on lake shores and as crystals in the blue mud of Clear Lake. The large crystals are picked out, washed with sodium hydroxide solution to remove fatty matter, and the saturated earth lixiviated, the solution evaporated and crystallized; may also be made from the natural borates—boracite, borosodocalcite, crystomorphite, etc., of Nevada, S. America, Europe, Asia. Mostly prepared from crude boric acid of Tuscany by fusing with sodium carbonate —$4H_3BO_3 + Na_2CO_3 = Na_2B_4O_7 + CO_2 + 6H_2O$. It is in colorless, transparent, monoclinic prisms, white powder, odorless, sweetish, alkaline taste, slightly efflorescent in warm, dry air, soluble in water (15), boiling water (.6), glycerin (1), insoluble in alcohol; contains 52.32–54.92 p. c. of anhydrous sodium borate, corresponding to 99 p. c. of crystallized salt. *Tests:* 1. When heated—at first loses part of water of crystallization, then melts, swells, forming white, porous mass; at red heat—loses all water of crystallization, fusing to colorless glassy mass. 2. Produces intense yellow flame, while a borax bead on platinum wire, dipped in glycerin, gives a transient bright green flame. 3. Aqueous solution (1 in 20) alkaline, turns turmeric paper reddish-brown, but if solution acidified with hydrochloric acid, turmeric paper remains unchanged at first, but brownish-red on drying, and greenish-black on moistening with ammonia water. *Impurities:* Heavy metals, arsenic, carbonate, bicarbonate. Should be kept in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.).

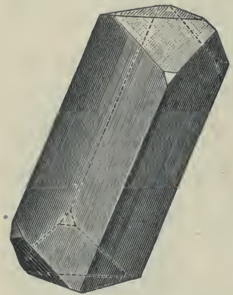


Fig. 451. — Sodium borate crystal.

Preparations.—1. *Unguentum Aquæ Rosæ*, 5 p. c.

Unoff. Preps.: Liquor Sodii Boratis Compositus (Dobell's Solution), 1.5 p. c., + sodium bicarbonate 1.5, liquefied phenol .3, glycerin 3.5, water q. s. 100. *Mel Sodii Boratis,* 10 p. c., + glycerin 5, clarified honey 85. *Mel Rosæ et Sodii Boratis,* 10 p. c., + glycerin 5, honey of rose 85. *Glycerinum Boracis* (Br.), $16\frac{2}{3}$ p. c. *Sodii Boro-Benzoas,* 43 p. c., + sodium benzoate 57.

Properties and Uses.—Identical with boric acid, disinfectant, antiseptic, astringent—dysmenorrhœa, uric acid diathesis, epilepsy, gravel; locally in aphthous ulceration, diphtheria, inflammation of the mouth, infantile diarrhœa, cystitis, ulcers, urethral and vaginal inflammations, scaly skin diseases (psoriasis, impetigo, eczema, etc.), prurigo pudendi, leucorrhœa, itching in urticaria, pruritus scroti et ani, conjunctivitis, gonorrhœa.

Incompatibles: Precipitates alkaloids, atropine, cocaine, morphine, quinine, etc., except in presence of glycerin, gelatinizes acacia, mucilage, decomposes alkali carbonates with effervescence, in presence of glycerin.

Sodii Perboras. Sodium Perborate, $NaBO_3 + 4H_2O$.—(Syn., Sod. Perbor.; Fr. Perborate de Soude; Ger. Natriumperborate.)

Manufacture: Mix boric acid (248), sodium peroxide (78), add these to cold water (2000) acidified with sulphuric acid (or carbon dioxide), wash separated crystals with alcohol, dry at 58° C. (136° F.). It is in white, crystalline granules, powder, odorless, saline taste, stable in cool dry air, but decomposed, evolving oxygen in warm moist air, soluble in water; saturated aqueous solution alkaline, decomposes into metaborate and hydrogen dioxide, gradually evolving oxygen, more rapidly when solution warmed—$NaBO_3 + H_2O = H_2O_2 + NaBO_2$; contains 9 p. c. of available oxygen, corresponding to 86.5 p. c. of pure salt. *Tests:* 1. Produces intensely yellow flame; turmeric paper moistened with acidulated (HCl) aqueous solution—brown, particularly on drying; on moistening dried test paper with ammonia water—color changed to greenish-black. 2. Shake aqueous solution (1 in 50) with diluted sulphuric acid each 1 Ml. (Cc.), + few drops of potassium dichromate T. S., + ether 2 Ml. (Cc.)—latter blue color. *Impurities:* Heavy metals, etc. Should be kept cool, in well-closed containers. Dose, gr. 1–2 (.06–.13 Gm.); chiefly externally.

Properties and Uses.—Antiseptic, deodorant, bactericide; wounds, purulent sores, varicose ulcers, toilet preparations, bleaching, disinfecting; similar to hydrogen dioxide, with the advantage of yielding an alkaline solution; applied as dusting powder, or in 2 p. c. solution.

Sodii Chloridum. Sodium Chloride, $NaCl$.—(Syn., Sod. Chlorid., Common (Table, Sea) Salt, Muriate of Sodium, Sal (Commune) Culinare, Chloruretum Sodicum; Fr. Chlorure de Sodium, Hydrochlorate de Soude, Sel de Cuisine, Sel commun or marin; Ger. Natrium chloratum (purum), Natriumchlorid, Chlornatrium, Kochsalz.)

Manufacture: The most abundant sodium compound, found native everywhere, but, for general use, obtained from crystalline rock-salt, which is mined extensively, sea-water and brine of salt-wells, these natural solutions furnishing by evaporation the largest supply. It is in colorless, transparent, cubical crystals, white, crystalline powder, odorless, purely saline taste, slightly hygroscopic (due to magnesium chloride); soluble in water (2.8), boiling water (2.7), glycerin (10), slightly in alcohol; aqueous solution (1 in 10) neutral; contains, when dried to constant weight, 99 p. c. of pure salt. *Tests:* 1. When heated—decrepitates; at red heat—fuses; at white heat—slowly volatilizes and partly decomposed; produces intense yellow flame. 2. Aqueous solution (1 in 20) with silver nitrate T. S.—white, curdy precipitate, insoluble in nitric acid, readily soluble in ammonia water. *Impurities:* Heavy metals, calcium, magnesium, bromide, iodide. Should be kept in well-closed containers. Dose, cathartic, ʒij–4 (8–15 Gm.); emetic, ℥ss–1 (15–30 Gm.), in warm water.

PREPARATION.—1. *Liquor Sodii Chloridi Physiologicus.* Physiological Solution of Sodium Chloride. (Syn., Liq. Sod. Chlor. Physio., Physiological Salt Solution, Normal Salt Solution.)

Manufacture: Dissolve sodium chloride 8.5 Gm. in freshly distilled water q. s. 1000 Ml. (Cc.), filter, sterilize, preferably in an autoclave, under steam pressure, at 115–120° C. (239–248° F.) for 15 minutes, or by boiling for 1 hour. Should not be used after it has been made 48 hours.

PROPERTIES AND USES.—Stomachic, tonic, anthelmintic, purgative, emetic, condiment, preservative; base of the sodium preparations; intermittent fever, hæmoptysis, phthisis, scrofula, diphtheria, dyspepsia, cholera, worms (ascarides), diabetes, albuminuria, to prevent alcoholic intoxication, congestion of the brain, epilepsy, emetic for narcotics and poisons in stomach, nasal catarrh, ulcers, sore mouth, pruritus, insect-sting, toothache, swellings, bruises, rheumatism, salt-bath, stimulant, for headache, uterine pain, eczema, psoriasis.

Sodii Indigotindisulphonas. Sodium Indigotindisulphonate, $C_{16}H_8O_2N_2(SO_3Na)_2$.—(Syn., Sod. Indigotin., Indigo Carmine, Ceruleinum; Fr. Indigo soluble, Indigodisulphonate de Sodium, Carmin d'indigo, Ceruleine; Ger. Indigosulfosaures Natrium.)

Manufacture: Add gradually, constantly stirring with glass rod, powdered indigo and ground glass each 1 Gm. to sulphuric acid 20 Ml. (Cc.), heat 1 hour at 85° C. (185° F.), cool, add water, q. s. 1000 Ml. (Cc.), filter from indigo-brown; mix filtered solutions and water each 50 Ml. (Cc.), add sodium chloride 32 Gm., let stand 2 hours, filter, wash precipitate with brine 50 Ml. (Cc.). This sodium salt of indigotindisulphonic acid is a blue powder, dark purple paste, which must be dried to constant weight before applying tests; sparingly soluble in water, yielding dark blue solution, almost insoluble in alcohol; when compressed acquires coppery lustre. *Tests:* 1. Add to aqueous solution (1 in 200) nitric acid, bromine water, or chlorine water—blue color discharged; similar result when warmed with sodium hydroxide and zinc dust, or with stannous chloride T. S. 2. Dissolve 1 Gm. in distilled water 200 Ml. (Cc.), filter through counterbalanced filters, wash filters and residue with distilled water until washings cease to be blue—dry insoluble residue on filter 2 p. c. *Impurities:* Iron ferricyanide, iron ferrocyanide, starch, starch iodide.

PROPERTIES AND USES.—Volumetric estimate of nitrates, chlorine.

Sodii Carbonas Monohydratus. Monohydrated Sodium Carbonate, $Na_2CO_3 + H_2O$.—(Syn., Sod. Carb. Monohyd.; Fr. Carbonate de Soude monohydraté; Ger. Einfachwasserhaltiges Natriumcarbonat.)

Manufacture: By crystallizing ordinary sodium carbonate above 35° C. (95° F.), having the advantage of being comparatively stable and non-efflorescent. It is a white, crystalline, granular powder, odorless, strongly alkaline taste; exposed to air absorbs some moisture, to warm, dry air above 50° C. (122° F.) effloresces, at 100° C. (212° F.)

—anhydrous; soluble in water (3), boiling water (1.8), glycerin (7), insoluble in alcohol; contains 99.5 p. c. of pure salt. *Tests:* 1. Aqueous solution (1 in 10) strongly alkaline; effervesces with acids; produces intensely yellow flame. *Impurities:* Heavy metals, etc. Should be kept in well-closed containers. Dose, gr. 5–15 (.3–1 Gm.), in powder or some bitter infusion.

PREPARATIONS.—1. *Liquor Sodæ Chlorinatæ,* 7 p. c. 2. *Massa Ferri Carbonatis,* 46 p. c.—36 p. c. ferrous carbonate. 3. *Suppositoria Glycerini,* $\frac{8}{10}$ gr. (.05 Gm.) or sodium stearate $3\frac{1}{2}$ gr. (.02 Gm.)—6.5 p. c.

Unoff. Preps.: Elixir Formatum, 3.6 p. c., + potassium carbonate 4.1, formic acid 22.5, +. *Elixir Formatum Compositum,* 2.3 p. c., + magnesium carbonate 2, strontium carbonate 2.5, lithium carbonate .8, quinine .77, formic acid 20, +.

FIG. 452.—Sodium carbonate crystal.

PROPERTIES.—Antacid, irritant, diuretic. Similar to bicarbonate, not much used internally, owing to its corrosive and poisonous action (like sodium hydroxide).

USES.—Gallstones, acidity of stomach or intestines, uric acid diathesis (gout), rheumatism, skin diseases, burns, scrofula, whooping-cough, liver congestion, vulvar pruritus, for making other sodium salts.

Poisoning: As for potassium hydroxide. Give fixed oils, acetic acid, vinegar, lemon juice, demulcents, relieve pain with opium or morphine.

Sodii Bicarbonas. Sodium Bicarbonate, $NaHCO_3$.—(Syn., Sod. Bicarb., Natrium Carbonicum Acidulum, Bicarbonas Sodicus, Sodium Hydrocarbonate, Acid Sodium Carbonate; Fr. Bicarbonate de Soude, Sel digestif de Vichy; Ger. Natrium bicarbonicum, Natriumbicarbonat, Doppeltkohlensaures Natron.)

Manufacture: 1. Treat sodium carbonate (crystals or solution) with carbon dioxide—$(Na_2CO_3 + 10H_2O) + CO_2 = 2NaHCO_3 + 9H_2O$; 2. *Solvay's Ammonia-soda Process:* Mix concentrated solution of sodium chloride with ammonia, and saturate with carbon dioxide under pressure—$NaCl + NH_3 + CO_2 + H_2O = NaHCO_3 + NH_4Cl$; here ammonium chloride remains in solution and sodium bicarbonate is precipitated, but contaminated with ammonium salts which are difficult to remove. It is a white, opaque powder, odorless, cooling, mildly alkaline taste, permanent, slowly decomposes in moist air, soluble in water (10), insoluble in alcohol, aqueous solution (1 in 20) slightly alkaline, increasing on standing, agitation, heating; contains, when dried to constant weight, 99 p. c. of pure salt. *Tests:* 1. When heated—decomposes into normal sodium carbonate, water, carbon dioxide; at 100° C. (212° F.)—loses 36.5 p. c.; at bright red heat—residue fuses; produces intense yellow flame; no odor of ammonia on heating in test-tube. 2. Aqueous solution (1 in 20)—clear, colorless, effervesces strongly with acids; heated above 15° C. (59° F.)—gradually loses carbon dioxide; at boiling—entirely converted into normal sodium carbonate. *Impurities:* Heavy metals, carbonate. Should be kept cool, in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.).

PREPARATIONS.—1. *Trochisci Sodii Bicarbonatis.* Troches of Sodium Bicarbonate. (Syn., Troch. Sod. Bicarb., Fr. Tablettes (Pastilles) de Bicarbonate de Soude, Pastilles (de Vichy) digestif; Ger. Natronpastillen.)

Manufacture: Triturate until fine powder myristica 1 Gm., sugar 54 Gm., gradually added, mix intimately with sodium bicarbonate 18 Gm., form mass with mucilage of tragacanth q. s., divide into 100 troches. Dose, 1–6 troches.

2. *Caffeina Citrata Effervescens,* 57 p. c. 3. *Ferri Carbonas Saccharatus,* 35 p. c. 4. *Potassii Citras Effervescens,* 47.7 p. c. 5. *Pulvis Effervescens Compositus,* 38.5 gr. (2.5 Gm.). 6. *Sodii Phosphas Effervescens,* 47.7 p. c.

Unoff. Preps.: Liquor Sodæ et Menthæ, 5 p. c., + aromatic spirit of ammonia 1, spearmint water q. s. 100. *Salia Effervescentia,* 28–84.6 p. c. *Sodii Citro-Tartras Effervescens* (Br.), 51 p. c., dose, ʒj–2 (4–8 Gm.).

PROPERTIES.—Antacid, diuretic, slight depressant and sedative.

USES.—Similar to potassium bicarbonate, but more slowly absorbed; dyspepsia, calculus, infantile croup, pneumonia, gravel, suppressed urine, diabetes, acute articular rheumatism, angina, pruritus, tonsillitis, ophthalmia, rhus toxicodendron poisoning, pain from burns, to dissolve diphtheritic membrane.

Incompatibles: Acids, acid salts, bismuth subnitrate.

Sodii Hydroxidum. Sodium Hydroxide, $NaOH$.—(Syn., Sod. Hydrox., Caustic Soda, Sodium Hydrate, Soda, U. S. P. 1890, Soda Caustica, Natrium (Causticum) Hydricum; Fr. Soude caustique; Ger. Natron, Ätznatron.)

Manufacture: (1) Decompose a solution of sodium carbonate with milk of lime, evaporate filtrate, congeal in molds; (2) allow metallic sodium to act on water—$Na + H_2O = NaOH + H$; (3) evaporate liquor sodii hydroxidi, pour into molds. It is in dry, white, nearly white, fused masses, sticks, hard, brittle, showing crystalline fracture (must exercise great caution in its use, as it rapidly destroys organic tissues), deliquescent, absorbs carbon dioxide becoming coated with carbonate, soluble in water (.9), boiling water (.3), alcohol; solution, even greatly diluted, strongly alkaline, produces intensely yellow flame; contains 90 p. c. of pure salt. *Impurities:* Potassium, organic matter, insoluble substances. Should be kept in well-closed containers, and if these are bottles they must be of hard glass. Dose, gr. 1–2 (.06–.13 Gm.), well diluted.

PREPARATIONS.—1. *Liquor Sodii Hydroxidi.* Solution of Sodium Hydroxide. (Syn., Liq. Sod. Hydrox., Liquor Sodæ, Solution of Soda, Solution of Sodium Hydrate, Natrium Hydricum Solutum, Solution of Caustic Soda; Fr. Soude caustique liquide, Lessive des Savonniers; Ger. Liquor Natri caustici, Ätznatronlauge.)

Manufacture: 5 p. c. Dissolve sodium hydroxide 5.6 Gm. in distilled water q. s. 100 Gm. It is a clear, colorless, odorless, aqueous liquid (solution), very acrid, caustic taste (even if largely diluted, when it only should be tasted), strongly alkaline, readily absorbs carbon dioxide from the air, sp. gr. 1.056; contains not less than 4.5 p. c. of sodium hydroxide. *Impurities:* Carbonate, etc. Should be kept in bottles made of hard glass, with rubber stoppers, or glass stoppers coated with petrolatum. Dose, ♏v–30 (.3–2 Ml. (Cc.)), well diluted.

Unoff. Prep.: Soda cum Calce, 50 p. c., + calcium oxide 50.

PROPERTIES.—Strong escharotic, destroys tissue like potassium hydroxide, and otherwise just like it only not quite so poisonous.

Poisoning, Incompatibles: Same as for potassium hydroxide.

Sodii Acetas. Sodium Acetate, $NaC_2H_3O_2 + 3H_2O$.—(Syn., Sod. Acet., Acetas Sodicus (Natricus), Terra Foliata Tartari (Crystallisata); Fr. Acétate de Soude; Ger. Natrium aceticum, Natriumacetat, Essigsaures Natron.)

Manufacture: Neutralize acetic acid with sodium carbonate or bicarbonate, evaporate, crystallize—$Na_2CO_3 + 2HC_2H_3O_2 = 2NaC_2H_3O_2 + H_2O + CO_2$, or from acetic acid in purifying wood vinegar. It is in colorless, transparent, monoclinic prisms, granular, crystalline powder, odorless, cooling, saline taste, efflorescent, soluble in water (.8), alcohol (19); aqueous solution (1 in 20) neutral, slightly alkaline; contains 59.97–62.96 p. c. of anhydrous sodium acetate, corresponding to 99.5 p. c. of crystallized salt. *Tests:* 1. Begins to liquefy at 58° C. (137° F.), becomes dry and anhydrous at 120° C. (248° F.), at higher temperature decomposes with inflammable, empyreumatic vapors, and black residue of sodium carbonate and carbon, which gives intense yellow flame, is alkaline and effervesces with acids. 2. Add .1 Gm. to sulphuric acid and alcohol each 1 Ml. (Cc.), warm—ethyl acetate, recognized by odor. *Impurities:* Heavy metals, arsenic, potassium. Should be kept in well-closed containers. Dose, gr. 15–60 (1–4 Gm.).

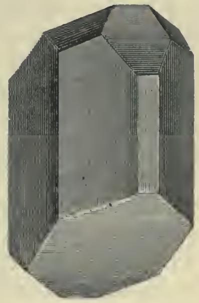


FIG. 453. — Sodium acetate crystal.

PROPERTIES AND USES.—Diuretic, rarely used in medicine, but to distil with sulphuric acid for acetic acid.

Sodii Citras. Sodium Citrate, $Na_3C_6H_5O_7 + 2H_2O$.—(Syn., Sod. Cit., Natrium Citricum; Fr. Citrate de Sodium (Soude); Ger. Natriumcitrat, Citronensaures Natron.)

Manufacture: Neutralize a solution of citric acid with sodium carbonate or bicarbonate, concentrate, crystallize. It is in small crystals, a white, granular powder, odorless, cooling, saline taste, soluble in water (1.3), boiling water (.6), insoluble in alcohol; aqueous solution (1 in 20) slightly alkaline to litmus, not reddened by 1 drop of phenolphthalein T. S.; contains 98 p. c. of pure salt. *Tests:* 1. Heat to 150° C. (302° F.)—loses all water of crystallization; ignite at red heat—carbonizes, emitting inflammable gases of pungent, acrid odor; residue—alkaline, strongly effervescing with acids. 2. Aqueous solution (1 in 20) and calcium chloride T. S., each 10 Ml. (Cc.)—liquid clear until boiled, then have a white, granular precipitate. *Impurities:* Heavy metals, arsenic. Should be kept in well-closed containers. Dose, diuretic, antilithic, gr. 10–45 (.6–3 Gm.); mild laxative, ℥ss–1 (15–30 Gm.).

PREPARATIONS.—(Unoff.): *Liquor Sodii Citratis,* citric acid 2 p. c., + sodium bicarbonate 2, dist. water 100. *Liquor Sodii Citro-Tartratis Effervescens,* sodium bicarbonate 26 Gm., tartaric acid 24, citric acid 2, syrup of citric acid 50, dist. water q. s. 350.

PROPERTIES AND USES.—Similar to but weaker than potassium citrate.

Sodii Benzoas. Sodium Benzoate, $NaC_7H_5O_2$; if in crystals, $NaC_7H_5O_2,H_2O$.—(Syn., Sod. Benz., Benzoas Sodicus; Fr. Benzoate de Soude; Ger. Benzoesaures Natron, Natriumbenzoat.)

Manufacture: Add sodium bicarbonate (7) to benzoic acid (10) suspended in hot water (20), after carbon dioxide evolved neutralize liquid, evaporate filtrate, frequently stirring (13.5)—$Na_2CO_3 + 2HC_7H_5O_2 = 2NaC_7H_5O_2 + H_2O + CO_2$. It is a white, amorphous, granular or crystalline powder, odorless, sweetish taste, permanent, soluble in water (1.8), boiling water (1.4), alcohol (61); contains when dried to constant weight 99 p. c. of pure salt. *Tests:* 1. Aqueous solution (1 in 20) neutral, slightly alkaline; with few drops of ferric chloride T. S.—flesh-colored precipitate. 2. When heated—vapors have odor of benzoic acid, then chars with a residue of sodium carbonate and carbon; produces intensely yellow flame. 3. Concentrated aqueous solution with diluted hydrochloric or sulphuric acid—voluminous, white precipitate (benzoic acid). *Impurities:* Heavy metals, etc. Should be kept in well-closed containers. Dose, gr. 10–30 (.6–2 Gm.), ter die.

Sodii Benzosulphinidum. Sodium Benzosulphinide, $NaC_7H_4O_3NS + 2H_2O$.—(Syn., Sod. Benzosulphin., Sodium Saccharin, Soluble Saccharin (Gluside), Crystallose; Fr. Sulfinide benzoique de soude; Ger. Natriumbenzoesäuresulfinid.)

Manufacture: Neutralize an aqueous solution of benzosulphinide (saccharin) with sodium bicarbonate, crystallize slowly. It is in colorless, rhombic prisms, white, crystalline powder, odorless, faint aromatic odor, intensely sweet taste, even in dilute solutions, somewhat efflorescent, soluble in water (1.2), alcohol (50). *Tests:* 1. Incinerate—residue chiefly sodium sulphate; aqueous solution (1 in 10)—neutral, slightly alkaline to litmus, but no red with phenolphthalein T. S. 2. Mix 10 Ml. (Cc.) of aqueous solution (1 in 10) with hydrochloric acid 1 Ml. (Cc.)—crystalline precipitate (benzosulphinide). *Impurities:* Benzoate, salicylate. Dose, gr. 1–4 (.06–.26 Gm.).

Properties and Uses.—As a substitute for benzosulphinide (saccharin), owing to its greater solubility.

Sodii Hypophosphis. Sodium Hypophosphite, $NaH_2PO_2 + H_2O$.—(Syn., Sod. Hypophos., Hypophosphis Sodicus; Fr. Hypophosphite de Soude; Ger. Natrium Hypophosphorosum Unterphosphorigsaures Natron.)

Manufacture: Add sodium carbonate to solution of calcium hypophosphite, filter, evaporate, granulate—$Na_2CO_3 + Ca(H_2PO_2)_2 = 2NaH_2PO_2 + CaCO_3$; should evaporate cautiously to avoid the giving off of inflammable hydrogen phosphide. It is in small, colorless, transparent, rectangular plates of pearly lustre, white granular powder, odorless, saline taste, deliquescent in moist air, soluble in water (1), boiling water (.15), glycerin, alcohol, boiling alcohol, slightly in dehydrated alcohol; aqueous solution (1 in 20) neutral, slightly alkaline; contains, when dried to constant weight, 98 p. c. of pure salt. *Tests:* 1. When heated—first loses water of crystallization, then decomposes, evolving spontaneously inflammable hydrogen phosphide, which burns with bright yellow flame. 2. Aqueous solution (1 in 20) acidulated with hydrochloric acid and added, drop by drop with agitation, to excess of mercuric chloride T. S.—white precipitate (mercurous chloride); upon further adding aqueous solution—precipitate gray from reduction to metallic mercury. 3. Heat for 30 minutes aqueous solution (1 in 5) 5 Ml. (Cc.) in test-tube with diluted hydrochloric acid .5 Ml. (Cc.)—no offensive odor. *Impurities:* Heavy metals, arsenic, phosphate. Should be kept in well-closed containers, and dispensed cautiously, as explosion is liable to occur when triturated or heated with nitrates, chlorates, or other oxidizing agents. Dose, gr. 5–30 (.3–2 Gm.), ter die, in water, syrup, or mixture.

Preparations.—1. *Syrupus Hypophosphitum,* 1.5 p. c.

Unoff. Prep.: Elixir Sodii Hypophosphitis, 3.5 p. c., + hypophosphorous acid .4, aromatic elixir q. s. 100.

Properties and Uses.—Stimulates the nervous system, aids digestion and nutrition, phthisis, chronic bronchitis, scrofula, syphilis, anæmia, impotence, promotes bone-formation. Generally combined with other hypophosphites, cod liver oil, etc.

Sodii Sulphis Exsiccatus. Exsiccated Sodium Sulphite, Na_2SO_3.—(Syn., Sod. Sulphis Exsic.; Fr. Sulphite de Soude desséché; Ger. Getrocknetes Natriumsulfit.)

Manufacture: Saturate a solution of sodium carbonate with sulphur dioxide, add sodium carbonate equal to original amount taken, evaporate, crystallize—$Na_2CO_3 + SO_2 = Na_2SO_3 + CO_2$; expose crystals ($Na_2SO_3 + 7H_2O$) 100 Gm. to 100° C. (212° F.), when they lose all water of crystallization (50 p. c.) without fusing or changing shape, pulverize, sift. It is a white powder, odorless, cooling, saline, sulphurous taste; on exposure slowly oxidizes to sulphate; soluble in water (3.2), sparingly in alcohol; aqueous solution (1 in 10) alkaline; contains 90

p. c. of pure salt. *Tests:* 1. At red heat—fuses to reddish-yellow mass of sodium sulphate and sulphide; produces intensely yellow flame. 2. With hydrochloric acid—sulphur dioxide liberated, recognized by odor, and blackening strip of paper moistened with mercurous nitrate T. S. *Impurities:* Heavy metals, arsenic, thiosulphate. Should be kept cool, in well-closed containers. Dose, gr. 5–15 (.3–1 Gm.).

Sodii Bromidum. Sodium Bromide, NaBr.—(Syn., Sod. Brom., Bromuretum Sodicum; Fr. Bromure de Sodium; Ger. Natrium bromatum, Natriumbromid, Bromnatrium.)

Manufacture: Similar to potassium bromide, using sodium hydroxide or sodium carbonate with bromine, or by double decomposition between ferrous bromide and sodium carbonate—$Na_2CO_3 + FeBr_2 = 2NaBr + FeCO_3$. It is in colorless, white, cubical crystals, white, granular powder, odorless, saline taste, absorbs moisture from air without deliquescing, soluble in water (1.1), alcohol (16); aqueous solution (1 in 20) neutral, faintly alkaline; contains, when dried to constant weight, 98.5 p. c. of pure salt. *Tests:* 1. Heat to bright red—fuses without decomposition, at higher temperature volatilizes; produces intense yellow flame. 2. Aqueous solution (1 in 10) with silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid, or excess of ammonia water. *Impurities:* Heavy metals, alkali, barium, bromate, iodide, sulphate. Should be kept in well-closed containers. Dose, gr. 10–60 (.6–4 Gm.), in water, elixir, syrup, or powder.

PREPARATION.—(Unoff.): *Elixir Sodii Bromidi,* 17.5 p. c., +. Dose, ʒj–2 (4–8 Ml. (Cc.)).

PROPERTIES AND USES.—Similar to those of potassium bromide, but less irritating to the stomach, and a weaker depressant. Epilepsy, insomnia, delirium tremens, nervous palpitation, nervousness at menopause, sea-sickness.

Poisoning, Incompatibles, Synergists: See Potassium Bromide, page 693.

Sodii Iodidum. Sodium Iodide, NaI.—(Syn., Sod. Iod.; Fr. Iodure de Sodium; Ger. Natrium jodatum (jodid), Jodnatrium, Natrium iodatum.)

Manufacture: Add iodine to a solution of sodium hydroxide (or sodium carbonate), or by double decomposition between ferrous iodide and sodium carbonate—$(Na_2CO_3 + 10H_2O) + FeI_2 = 2NaI + FeCO_3 + 10H_2O$. It is in colorless, cubical crystals or white crystalline powder, odorless, saline taste, deliquescent, at first caking, often decomposes, assuming brown tint, soluble in water (.55), boiling water (.4), alcohol (2), glycerin (1); aqueous solution (1 in 20) neutral, slightly alkaline; contains not more than 7 p. c. of moisture, when dried to constant weight, 99 p. c. of pure salt. *Tests:* 1. When strongly heated—melts; at bright red heat—slowly volatilizes, partly decomposed; produces intense yellow flame. 2. Add to 5 Ml. (Cc.) of aqueous solution (1 in 20) ferric chloride T. S. and distilled water, each 1 Ml. (Cc.), shake, add 5 Ml. (Cc.) of chloroform—latter violet color.

Impurities: Heavy metals, barium, potassium, alkali, cyanide, iodate, nitrate, nitrite, sulphate, thiosulphate, moisture. Should be kept in well-closed containers. Dose, gr. 2–30 (.13–2 Gm.), ter die, in water, elixir, syrup.

PROPERTIES AND USES.—Same as potassium iodide, only is less depressing and irritating, Constitutional syphilis, chronic eczema; with arsenic in lepra, psoriasis, also as a stimulant and antiseptic in foul ulcers, sores, fetor in general.

Poisoning, Incompatibles: See Iodine, page 680.

Sodii Salicylas. Sodium Salicylate, $NaC_7H_5O_3$.—(Syn., Sod. Salicyl.; Fr. Salicylate de Soude; Ger. Natrium salicylicum, Natriumsalicylat.)

Manufacture: Neutralize salicylic acid (16.5) with sodium bicarbonate (10), in distilled water (10), after effervescence, evaporate solution at 60° C. (140° F.) to dryness—$Na_2CO_3 + 2HC_7H_5O_3 = 2NaC_7H_5O_3 + H_2O + CO_2$; solution must remain slightly acid, as alkali salicylates having excess of alkali absorb oxygen and become colored. It is a white, micro-crystalline powder, scales, amorphous powder, colorless, faint pink tinge, odorless, faint characteristic odor, sweet, saline taste, soluble in glycerin, water (.9), alcohol (9.2), more soluble in boiling water, boiling alcohol; aqueous solution (1 in 10) when fresh colorless, nearly colorless, neutral, slightly acid; contains, when dried to constant weight, 99.5 p. c. of pure salt. *Tests:* 1. When heated—decomposes, giving off inflammable vapors, phenol odor, and residue of sodium carbonate and carbon; produces intensely yellow flame. 2. Excess of concentrated aqueous solution (1 in 4) with a few drops of ferric chloride T. S.—dark red color and precipitate with hydrochloric acid or sulphuric acid—voluminous white precipitate; solution (1 in 100) produces deep violet-blue color. *Impurities:* Heavy metals, sulphite, thiosulphate. Should be kept from heat and light, in well-closed containers. Dose, gr. 15–30 (1–2 Gm.), ter die, in elixir, water.

PREPARATIONS.—(Unoff.): *Elixir*, 8.5 p. c. *Elixir Comp.*—sodium salicylate 8, fldext. of cimicifuga 3.2, fldext. of gelsemium 1.6, potassium iodide 1.5, +.

PROPERTIES AND USES.—Same as salicylic acid (page 858), but not so irritating, and is absorbed more rapidly; it lowers temperature, lessens pain; rheumatism, neuralgia, tonsillitis, dysmenorrhœa, pruritus, whooping-cough, migraine, cholera infantum, diarrhœa, variola, orchitis, rheumatic iritis, biliary colic, acute pleurisy, sciatica, to prevent formation of gallstones, diabetes.

Sodii Sulphas. Sodium Sulphate, $Na_2SO_4 + 10H_2O$.—(Syn., Sod. Sulph., Glauber's Salt, Sulfas Sodicus (Natricus); Fr. Sulfate de Soude, Sel de Glauber; Ger. Natrium sulfuricum, Natriumsulfat, Glaubersalz.)

Manufacture: As a by-product in making soda-ash, hydrochloric acid, nitric acid, ammonium chloride, carbonated waters, etc.; neutralize residue thus left with sodium carbonate, filter, evaporate, crystallize—$2NaHSO_4 + Na_2CO_3 = 2Na_2SO_4 + CO_2 + H_2O$. It is in large, colorless, transparent, monoclinic prisms, or granular crystals, odorless, bitter, saline taste, effloresces rapidly in air, soluble in water (1), glycerin, insoluble in alcohol; aqueous solution (1 in 10) neutral; contains 43.64–48 p. c. of anhydrous sodium sulphate, corresponding to 99 p. c. of crystallized salt. *Tests:* 1. Heat to 33° C. (92° F.)—melts in its water of crystallization; heat gently—fuses; at 100° C. (212° F.)—loses all water of crystallization (56 p. c.); at red heat—anhydrous salt fuses without decomposition; produces intensely yellow flame. 2. Aqueous solution (1 in 20) with barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. *Impurities:* Heavy metals, arsenic. Should be kept cool, in well-closed containers. Dose, purgative, ʒij–8 (8–30 Gm.).

Properties and Uses.—Hydragogue cathartic, diuretic; the strongest sodium purgative. When effloresced (dehydrated) it is twice as strong, hence dose should be only one-half. Largely used in veterinary practice, but for man is so harsh that magnesium sulphate almost always is substituted. Used in constipation, plethora, typhoid fever, dysentery, gastric ulcers, to neutralize phenol (carbolic acid) corrosion, to make sodium carbonate and glass. The bitter, nauseous taste may be overcome by flavoring with aromatic syrup, lemon, etc.

Sodii Phosphas. Sodium Phosphate, $Na_2HPO_4 + 12H_2O$.—(Syn., Sod. Phos., Sodium Orthophosphate, Phosphas Sodicus (Natricus), Disodium Hydrogen Phosphate; Fr. Phosphate de Soude; Ger. Natrium phosphoricum, Natriumphosphat, Phosphorsaures Natron.)

Manufacture: Digest bone-ash with H_2SO_4, which forms acid calcium phosphate—$Ca_3(PO_4)_2 + 2H_2SO_4 = Ca(H_2PO_4)_2 + 2CaSO_4$; filter, heat, add sodium carbonate to the solution, evaporate filtrate, crystallize—$Ca(H_2PO_4)_2 + 2Na_2CO_3 = 2Na_2HPO_4 + CaCO_3 + H_2O + CO_2$. It is in large, colorless, monoclinic prisms or granular, crystalline salt, odorless, cooling, saline taste, efflorescent, soluble in water (2.7), insoluble in alcohol; aqueous solution (1 in 10) alkaline; contains 39.25–44.00 p. c. of anhydrous sodium di-ortho-phosphate, corresponding to 99 p. c. of crystallized salt. *Tests:* 1. Heated above 40° C. (104° F.)—fuses, yielding colorless liquid; at 100° C. (212° F.)—loses all water of crystallization; at red heat—converted into sodium pyrophosphate. 2. Aqueous solution (1 in 20) with magnesia mixture T. S.—white, crystalline precipitate; produces intensely yellow flame. *Impurities:* Heavy metals, arsenic, calcium, aluminum, carbonate, chloride. Should be kept cool, in well-closed containers. Dose, alterative, gr. 20–40 (1.3–2.6 Gm.); purgative, ʒij–6 (8–24 Gm.).

Preparations.—1. *Sodii Phosphas Exsiccatus.* Exsiccated Sodium Phosphate. (Syn., Sod. Phos. Exsic., Natrium Phosphoricum Exsiccatum, Dried (Anhydrous) Sodium Phosphate; Fr. Phosphate de Soude desséché; Ger. Getrocknetes Natriumphosphat.)

Manufacture: Allow sodium phosphate crystals 100 Gm. to effloresce several days in warm air at 25–30° C. (77–86° F.), continue the drying in an oven, gradually increasing the heat to 100° C. (212° F.), until salt ceases to lose weight; powder and sift. It is a white powder which absorbs moisture readily, soluble in water (8.1), boiling water (1.1), insoluble in alcohol; contains, when dried to constant weight, 9 p. c. of pure salt. Should be kept in well-closed containers. Dose, gr. 10–60 (.6–4 Gm.).

Prep.: 1. *Sodii Phosphas Effervescens.* Effervescent Sodium Phosphate. (Syn., Sod. Phos. Eff., Natrium Phosphoricum Effervescens; Fr. Phosphate de Soude Effervescent; Ger. Brausendes Natriumphosphat.)

Manufacture: Mix powdered citric acid 16.2 Gm., with exsiccated sodium phosphate 20 Gm., tartaric acid 25.2 Gm., then incorporate sodium bicarbonate 47.7 Gm.; heat in an oven at 93–104° C. (199–219° F.); when mixture moist from careful manipulation with wooden spatula, rub through No. 6 tinned-iron sieve, dry granules at 54° C. (130° F.). Should be kept in well-stoppered (sealed) containers. Dose, ʒj–4 (4–15 Gm.).

Unoff. Prep.: Liquor Sodii Phosphatis Compositus, official 1890–1910—heat until liquefied sodium phosphate crystals 100 Gm., citric acid 13, add glycerin 15, water q. s. 100 Ml. (Cc.), dose, ʒj–2 (4–8 Ml. (Cc.)), in water (hot) 1 hour before meals.

Properties and Uses.—Hepatic stimulant, mild purgative, alterative, scrofula, rachitis, diabetes, scrofulous ophthalmia, bowel complaint, diarrhœa, jaundice, fevers.

Sodii Arsenas. Sodium Arsenate, $Na_2HAsO_4 + 7H_2O$.—(Syn., Sod. Arsen., Sodii Arsenias, Arsenias Natricus (Sodicus), Arseniate (Arsenate) of Soda; Fr. Arséniate de Soude; Ger. Natriumarsenat (arsenicum), Arsensaurus Natron.)

Manufacture: Heat arsenic trioxide (10), sodium nitrate (8.5), and dried sodium carbonate (5.5) to redness, dissolve fused mass in water (35), crystallize—$As_2O_3 + 2NaNO_3 + Na_2CO_3 = Na_4As_2O_7 + N_2O_3 + CO_2$. Upon the addition of water to the warm mass, one molecule is combined, thereby converting the sodium pyroarsenate into the orthoarsenate, and as such crystallizes upon standing—$Na_4As_2O_7 + 15H_2O = 2(Na_2HAsO_4, 7H_2O)$. It is in colorless, transparent, monoclinic prisms; odorless, efflorescent, deliquescent, mild alkaline taste (use great care in tasting and then only in very dilute solutions), soluble in water (1.5), boiling water (1), slightly in alcohol, nearly insoluble in boiling alcohol; contains 58.98–61.92 p. c. of anhydrous sodium arsenate (di-sodium ortho-arsenate), corresponding to 99 p. c. of crystallized salt. *Tests:* 1. Heat gently — loses 5 molecules of water, being converted into a white powder; at higher temperature—loses all water

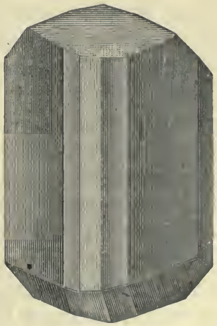


Fig. 454.—Sodium arsenate crystal.

of crystallization; strongly heated—fuses, and at red heat—converted into pyroarsenate. Should be kept in well-closed containers. Dose, gr. $\frac{1}{16}$–$\frac{1}{8}$ (.004–.008 Gm.).

PREPARATIONS.—1. *Sodii Arsenas Exsiccatus.* Exsiccated Sodium Arsenate. (Syn., Sod. Arsen. Exsic.; Br. Sodii Arsenas Anhydrosus; Natrium Arsenicum Exsiccatum, Dried (Anhydrous) Arsenate of Soda; Fr. Arseniate de Soude desséché; Getrocknetes Natriumarsenat.)

Manufacture: Break into small fragments sodium arsenate crystals 100 Gm., allow them to effloresce at 40–50° C. (104–122° F.) until disintegrated, heat at 150° C. (302° F.) until product ceases to lose weight, pulverize. It is an odorless, amorphous, white powder, slightly hygroscopic, mildly alkaline taste (use great care in tasting and then only in very dilute solutions), soluble in water (3.1), boiling water (1.3), slightly in alcohol, nearly insoluble in boiling alcohol; contains when dried to constant weight, 98 p. c. of pure salt. *Tests:* 1. Aqueous solution (1 in 20) alkaline, produces intense yellow flame. 2. Aqueous solution with barium chloride T. S.—white precipitate, soluble in nitric acid; with silver nitrate T. S.—dark red precipitate, soluble in nitric acid. *Impurities:* Lead, copper, iron, arsenite. Should be kept in well-closed containers. Dose, gr. $\frac{1}{24}$–$\frac{1}{12}$ (.0025–.005 Gm.).

Prep.: 1. *Liquor Sodii Arsenatis.* Solution of Sodium Arsenate. (Syn., Liq. Sod. Arsen., Solution of Arseniate of Sodium; Fr. Liqueur (Soluté) d'Arseniate de Soude; Ger. Arsensaure Natronlösung.)

Manufacture: 1 p. c. Dissolve exsiccated sodium arsenate 1 Gm. in distilled water q. s. 100 Gm.; this aqueous solution contains .975–1.025 p. c. of sodium arsenate, and while it is a substitute for Pearson's Solution, the latter, it should be remembered, is only one-tenth as strong as the official liquor. Dose, ♏iij–6 (.2–.4 Ml. (Cc.)), diluted.

Unoff. Prep.: Liquor Sodii Arsenatis, Pearson, .1 p. c.

PROPERTIES AND USES.—Similar to arsenic trioxide. Liquor—identical with liquor potassii arsenitis in strength, but is said to cause poisoning less easily and does not irritate stomach so readily. Used in same diseases as arsenic trioxide—neuralgia, chronic malaria, nervous debility, chorea, eczema, anæmia, etc.

Poisoning: Same as for arsenic trioxide.

Sodii Cacodylas. Sodium Cacodylate, $Na(CH_3)_2AsO_2$.—(Syn., Sod. Cacodyl., Sodium Dimethylarsenate, Sodium Cacodylate; Fr. Cacodylate de Soude; Ger. Natriumkakodylat.)

Manufacture: Distil arsenous oxide with potassium acetate, oxidize distillate (cacodyl, $As_2(CH_3)_4$, and cacodyl oxide, $As_2(CH_3)_4O$), with mercuric oxide, neutralize cacodylic acid with solution of sodium hydroxide, concentrate to crystallization. It is in white, odorless, deliquescent prisms, granular powder, soluble in water (.5), alcohol (2.5); contains 72–75 p. c. of pure salt, and variable amount of water of crystallization. *Tests:* 1. Melts in its water of crystallization at

60° C. (140° F.), becomes anhydrous at 120° C. (248° F.), burning with bluish flame of garlic-like odor. 2. Aqueous solution (1 in 100) few drops, + hypophosphorous acid 2 Ml. (Cc.), let stand in stoppered tube—odor of cacodyl in an hour. *Impurities:* Heavy metals, monomethylarsenate, arsenate, chloride, phosphate, sulphate. Should be kept in well-closed containers. Dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.), in pill, enema, hypodermically.

Properties and Uses.—Alterative, hæmatic—similar to other arsenic compounds, but much less toxic and prone to undesirable effects, owing to slow liberation of arsenous acid in the body: psoriasis, leukemia, chlorosis, anæmia, tuberculosis, malarial cachexia, diabetes, chorea, skin diseases.

Sodii Cyanidum. Sodium Cyanide, $NaCN$.—(Syn., Sod. Cyanid., Natrium (Sodium) Cyanatum; Fr. Cyanure de Sodium (Soude); Ger. Natriumcyanid, Cyannatrium.)

Manufacture: (1) Fuse sodium carbonate with calcium cyanide, leach the melt with hot water, filter, evaporate; (2) heat metallic sodium, coal, and sodium cyanide with ammonia at above the melting point of sodium cyanide; (3) pass hydrocyanic acid gas into alcoholic solution of sodium hydroxide, when sodium cyanide separates as a bulky crystalline precipitate. It is in white, opaque, amorphous pieces, white, granular powder, odorless (dry), deliquescent in the air, emitting odor of hydrocyanic acid (must use great caution in handling), freely soluble in cold water; aqueous solution (1 in 20) strongly alkaline, emitting odor of hydrocyanic acid; contains 95 p. c. of pure salt. *Tests:* 1. Fuses at low red heat, produces intense yellow flame; aqueous solution (1 in 20) few drops, with silver nitrate T. S.—white precipitate, soluble in excess of sodium cyanide solution or ammonia water. 2. Aqueous solution 5 Ml. (Cc.) with a few drops each of ferrous sulphate T. S. and ferric chloride T. S., + slight excess of hydrochloric acid—blue precipitate (iron ferrocyanide). *Impurities:* Ferrocyanide, sulphocyanate. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{20}$–$\frac{1}{4}$ (.003–.015 Gm.), dissolved in water.

Properties.—Same as cyanide of potassium, and hydrocyanic acid as a poison and medicine. Sedative, antispasmodic, anodyne.

Uses.—Spasmodic cough, nervous irritability, dyspnœa, asthma, phthisis, catarrh, whooping-cough; headache from dyspepsia, menstruation, etc.; very fleeting and dangerous (full dose), hence rarely employed. *Poisoning:* Similar to hydrocyanic acid; place in recumbent position, give fresh air, iron mixture (iron sulphate, gr. 10 (.6 Gm.) + tincture ferric chloride ʒj (4 Ml. (Cc.)) + water ℥j (30 Ml. (Cc.)), emetics, atropine, stimulants (ether, brandy, inhale ammonia, warmth), demulcents.

Sodii Glycerophosphas. Sodium Glycerophosphate, $Na_2C_3H_7PO_6$.—(Syn., Sod. Glycerophos., Sodium Glycerophosphate, Disodium Monoglycerophosphate, Hydrated Sodium Glycerophosphate, Sodium

Glycerino-phosphoricum; Fr. Glycéro-phosphate de Sodium (Soude); Ger. Natriumglycerinophosphat.)

Manufacture: Neutralize a solution of glycerophosphoric acid with sodium carbonate or bicarbonate, concentrate filtrate. It is in white, monoclinic plates, scales, white powder, saline taste, odorless, very soluble in water (cold, hot), nearly insoluble in alcohol; aqueous solution (1 in 20) alkaline; contains 68 p. c. of anhydrous salt. *Tests:* 1. When strongly heated—decomposes, evolving inflammable vapors; at red heat—converted into sodium pyrophosphate. *Impurities:* Heavy metals, free alkali, phosphates, alcohol-soluble substances. Dose, gr. 5–10 (.3–.6 Gm.), ter die, in powder or subcutaneously.

PREPARATIONS.—1. *Liquor Sodii Glycerophosphatis.* Solution of Sodium Glycerophosphate. (Syn., Liq. Sod. Glycerophos.; Fr. Soluté Glycéro-phosphate de Soude; Ger. Natriumglycerinophosphat.)

Manufacture: An aqueous solution of glycerophosphate containing not less than 50 p. c. of the anhydrous salt. It is a clear, colorless, yellowish, more or less syrupy liquid in other respects conforming to reactions and tests for purity under sodii glycerophosphas. Dose, ♏v–15 (.3–1 Ml. (Cc.)).

Unoff. Prep.: Elixir Glycerophosphatum Compositum, 4 p. c. (solution), + calcium glycerophosphate 1.6, ferric glycerophosphate .3, soluble manganese glycerophosphate .2, quinine glycerophosphate .1, strychnine glycerophosphate .015, lactic acid 1, +.

PROPERTIES AND USES.—Nervine, tonic, where system needs phosphorus. Nervous asthma, neurasthenia, deficient nutrition, Addison's disease, phosphaturia, goiter, convalescence; substitute for pilocarpus when latter objectionable.

Sodii Nitris. Sodium Nitrite, $NaNO_2$.—(Syn., Sod. Nitris; Fr. Nitrite de Soude; Ger. Salpetrigsaures Natron.)

Manufacture: Heat together sodium nitrate, charcoal, and starch, wash out the nitrite with water; or, better, heat fused sodium nitrate (3 hours) with lead in thin sheets—$2NaNO_3 + Pb_2 = 2NaNO_2 + 2PbO$; lixiviate mass with water, treat solution with carbon dioxide (to remove trace of lead), crystallize filtrate. It is in white, nearly white, opaque, fused masses, sticks, colorless, transparent, hexagonal crystals, granular powder, odorless, mild saline taste, deliquescent, gradually oxidized to sodium nitrate, becoming unfit for use, soluble in water (1.5), more so in boiling water, sparingly in alcohol; aqueous solution (1 in 10) slightly alkaline; contains, when dried to constant weight, 95 p. c. of pure salt. *Tests:* 1. When heated—melts; at red heat—decomposes, yielding oxygen, nitrogen, nitrogen dioxide, sodium oxide; produces intensely yellow flame. 2. Mix 5 Ml. (Cc.) of aqueous solution (1 in 10) with potassium iodide T. S. and hydrochloric acid, each 5 drops—iodine liberated, nitrogen dioxide escapes with effervescence. *Impurities:* Heavy metals, etc. Should be kept in well-closed containers. Dose, gr. 2–3 (.13–.2 Gm.), ter die.

PREPARATION.—1. *Spiritus Ætheris Nitrosi.*

Properties and Uses.—Similar to nitroglycerin and amyl nitrite, but is milder and more uniform; angina pectoris, asthma, dyspnœa, headache, hemicrania, epilepsy; dilates the vessels, lowers blood-pressure.

Sodii Phenolsulphonas. Sodium Phenolsulphonate, $NaC_6H_5O_4S + 2H_2O$.—(Syn., Sod. Phenolsulph., Sodium Sulphocarbolate, Sodii Sulphocarbolas (Paraphenol-sulphonate); Fr. Sulphophénate de Soude; Ger. Phenolsulfosaures Natrium.)

Manufacture: Mix equal weights of phenol (crystals) and sulphuric acid, heat for 6 hours on boiling water-bath (until forming clear solution with water), add water (10), also excess of barium carbonate, heat at 100° C. (212° F.) until acid neutralized, concentrate filtrate of barium phenolsulphonate, double decompose with sodium carbonate, concentrate filtrate, set aside to crystallize—(1) $C_6H_5OH + H_2SO_4 = HSO_3C_6H_4OH + H_2O$; (2) $2HSO_3C_6H_4OH + BaCO_3 = Ba(SO_3C_6H_4(OH))_2 + H_2O + CO_2$; (3) $Ba(SO_3C_6H_4(OH))_2 + Na_2CO_3 = 2NaSO_3C_6H_4(OH) + BaCO_3$. It is in colorless, transparent, rhombic prisms, crystalline granules, odorless, cooling, saline, bitter taste, efflorescent, soluble in water (4.2), boiling water (.8), alcohol (140), boiling alcohol (13.5), glycerin (5); aqueous solution (1 in 10) neutral; contains 83.64–87.82 p. c. of anhydrous sodium para-phenolsulphonate, corresponding to 99 p. c. of crystallized salt. *Tests:* 1. Heat above 100° C. (212° F.)—loses water of crystallization, becoming white; at higher temperature—chars, emitting inflammable vapors of phenol odor, with residue of sodium sulphate; produces intensely yellow flame. 2. Aqueous solution (1 in 100) with ferric chloride T. S.—pale violet, but clear; with barium chloride T. S. original salt solution clear, but if salt ignited and residue dissolved in distilled water, + barium chloride T. S.—copious white precipitate. *Impurities:* Heavy metals, phenol. Should be kept in well-closed containers. Dose, gr. 3–15 (.2–1 Gm.); mostly in injection, spray.

Properties and Uses.—Antiferment, phthisis, typhoid fever, eruptive fevers, scarlatina, fermentation, dyspepsia, diarrhœa, gangrene, diphtheria, thrush, vomiting in pregnancy.

Sodii Thiosulphas. Sodium Thiosulphate, $Na_2S_2O_3 + 5H_2O$.—(Syn., Sod. Thiosulph., Sodium Hyposulphite, Hyposulphis Sodicus; Fr. Hyposulphite de Soude, Sulphite sulfuré de Soude; Ger. Natrium thiosulfuricum, Natriumthiosulfat, Natrium hyposulphurosum (subsulfurosum), Unterschwefligsaures Natron.)

Manufacture: By boiling solution sodium sulphite with sulphur—$Na_2SO_3 + S = Na_2S_2O_3$, or boiling $6NaOH + S_{12} = Na_2S_2O_3 + 2Na_2S_5 + 3H_2O$, or on larger scale by double decomposition of sodium carbonate with calcium thiosulphate—$Na_2CO_3 + CaS_2O_3 = Na_2S_2O_3 + CaCO_3$. This is not, as sometimes considered, a true hyposulphite ($NaHSO_2$), which, however, can be made thus: $3NaHSO_3 + Zn = NaHSO_2 + Na_2SO_3 + ZnSO_3 + H_2O$. It is in colorless, transparent, monoclinic prisms, odorless, cooling, bitter taste, permanent below 33°

C. (92° F.), efflorescent above that in dry air, slightly deliquescent in moist air, soluble in water (.5), insoluble in alcohol, rapidly decomposed at boiling; aqueous solution (1 in 10) neutral, faintly alkaline; contains 63.07–67.48 p. c. of anhydrous sodium thiosulphate, corresponding to 99 p. c. of crystallized salt. *Tests:* 1. Heat rapidly—melts; heat slowly until effloresced, then to 100° C. (212° F.)—undergoes partial decomposition, loses all water of crystallization; at red heat — decomposed, liberating sulphur, with residue of sodium sulphite and sulphate; produces intensely yellow flame. 2. Aqueous solution readily dissolves compounds of silver (bromide, chloride, iodide, oxide, etc.), and decolorizes solutions of iodine, or starch iodide; aqueous solution (1 in 10) 5 Ml. (Cc.) with a few drops of ferric chloride T. S.—dark violet color, rapidly disappearing upon agitation. *Impurities:* Heavy metals, arsenic, calcium, sulphite, bisulphite. Should be kept in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.), also in baths, ointments.

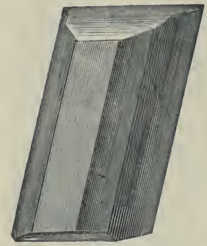


Fig. 455.—Sodium thiosulphate crystal.

Allied Salts:

1. *Sodii Nitras. Sodium Nitrate, Chile Saltpetre,* $NaNO_3$, official 1870–1910.—Obtained natively in Chile, Peru, etc., as a stratum (terra salitrosa) composed of various salts, from which the sodium nitrate is extracted by boiling water, crystallizing. It is in colorless, transparent rhombohedral crystals, odorless, cooling, saline, slightly bitter, hygroscopic, soluble in water (1.1), alcohol (100), at high heat evolves oxygen becoming nitrite, deflagrates with charcoal; contains 99 p. c. of pure salt. *Impurities:* Heavy metals, iodide. Refrigerant, diuretic, purgative; dysentery, epilepsy, angina pectoris, laryngitis, diarrhœa. Should be kept in well-closed containers. Dose, purgative, during the day, ʒ 4–8 (15–30 Gm.); for other conditions, gr. 15–30 (1–2 Gm.).

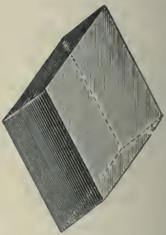


Fig. 456. — Sodium nitrate crystal.

2. *Sodii Carbonas. Sodium Carbonate,* $Na_2CO_3 + 10H_2O$, official 1830–1900. Obtained by several processes: 1. *Leblanc's:* (1) $2NaCl + H_2SO_4 = Na_2SO_4 + 2HCl$. (2) $Na_2SO_4 + 4C + CaCO_3$ + heat $= Na_2CO_3 + CaS + 4CO$; the resulting mass (black-ash) is washed with water, thereby dissolving out the sodium carbonate. 2. *Cryolite:* This mineral is found in Greenland, being the double fluoride of aluminum and sodium. (1) $Al_2F_6 6NaF + 6CaCO_3$ + heat $= Al_2O_3 3Na_2O + 6CaF_2 + 6CO_2$. (2) $Al_2O_3 3Na_2O + 3CO_2 + 3H_2O = 3Na_2CO_3 + 2Al(OH)_3$. The sodium aluminate is dissolved out by lixiviation with water, and into this solution CO_2 is passed, under pressure, which, decomposing, precipitates aluminum hydroxide together with a little Na_2CO_3, while most of the pure Na_2CO_3 remains

in solution only to be crystallized out. 3. *Solvay's:* (1) $NaCl + 2NH_3 + 2CO_2 + 2H_2O$, under pressure $= NaHCO_3 + NH_4HCO_3 + NH_4Cl$. (2) $NH_4HCO_3 + NaCl = NaHCO_3 + NH_4Cl$. (3) $2NaHCO_3$ + heat $= Na_2CO_3 + H_2O + CO_2$. It is in colorless, monoclinic crystals, odorless, alkaline taste, effloresces, losing one-half of its water of crystallization (31.46 p. c. by weight), becoming a white powder; soluble in water (1.6), glycerin (1.02), insoluble in alcohol, ether. *Impurities:* Iron, lead, arsenic, aluminum, ammonia, calcium, potassium, sulphates, chlorides, sulphite, hyposulphite, sulphocyanate. Should be kept in well-closed vessels. Dose, gr. 10–30 (.6–2 Gm.).

3. *Sodii Carbonas Exsiccatus. Dried Sodium Carbonate,* official 1830–1900. Obtained by exposing ordinary sodium carbonate 200 Gm., in broken crystals, for several days to warm air until effloresced and disintegrated; heat at 45° C. (113° F.) until reduced to 100 Gm. It is in loose white powder responding to reactions of monohydrated sodium carbonate. Dose, gr. 5–15 (.3–1 Gm.). Properties and uses of these two carbonates identical with that of the official salt.

4. *Sodii Bisulphis. Sodium Bisulphite,* $NaHSO_3$, official 1880–1910.—Obtained by saturating a solution of sodium carbonate (bicarbonate) with SO_2, crystallizing in a cool place—$Na_2CO_3 + 2H_2O + 2SO_2 = 2NaHSO_3 + H_2O + CO_2$. It is in opaque, prismatic crystals, granular powder, odor of SO_2, taste disagreeable, sulphurous; on exposure loses $SO = SO_2$, becoming oxidized into sulphate; soluble in water (3.5), alcohol (70); strongly heated decrepitates; contains 90 p. c. of pure salt. *Impurities:* Heavy metals, thiosulphate. Checks putrifaction, fermentation, yeasty vomiting, aphthous sore throat, neutralizes chlorine in bleaching fabrics. Should be kept cool, in small, well-filled, well-stoppered containers. Dose, gr. 5–30 (.3–2 Gm.).

5. *Sodii Chloras. Sodium Chlorate,* $NaClO_3$, official 1880–1910.—Obtained by adding sodium carbonate crystals (9) to tartaric acid (9.5) in solution (hot), add this to potassium chlorate (8) in solution—(1) $Na_2CO_3 + 2H_2C_4H_4O_6 = 2NaHC_4H_4O_6 + H_2O + CO_2$. (2) $NaHC_4H_4O_6 + KClO_3 = NaClO_3 + KHC_4H_4O_6$. It is in colorless, transparent crystals (regular cubes with tetrahedral facets) or a crystalline powder, odorless, cooling, saline taste, permanent, soluble in water (1), glycerin (5), alcohol (100), melts when heated, giving off oxygen (45 p. c. by weight), leaving a residue of sodium chloride; contains 99 p. c. of pure salt. *Impurities:* Lead, copper, potassium, etc. Same as potassium chlorate, only more soluble, and therefore may be used in more concentrated solution. Should be kept in well-stoppered containers, and handled cautiously, as dangerous explosions may occur if heated, subjected to concussion or trituration with organic substances (cork, tannin, sugar, sulphur, antimony sulphide, phosphorus, gambir, catechu, glycerin, etc.). Dose, gr. 5–15 (.3–1 Gm.).

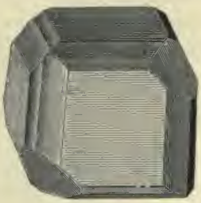


FIG. 457. — Sodium chlorate crystal.

6. *Sodii Pyrophosphas. Sodium Pyrophosphate,* $Na_4P_2O_7 + 10H_2O$, official 1880–1910.—Obtained by heating sodium phosphate to dull redness—$2(Na_2HPO_4 + 12H_2O) = Na_4P_2O_7 + 25H_2O$. It is in colorless, transparent, monoclinic prisms, crystalline powder, odorless, cooling, saline, feebly alkaline taste, efflorescent in warm air, soluble in water (11.5), insoluble in alcohol, at 100° C. (212° F.) loses its water of crystallization (40.35 p. c.); contains in an uneffloresced condition 99 p. c. of pure salt. *Impurities:* Heavy metals, arsenic, carbonate, ortho-phosphate. Same as phosphate. Dose, ʒj–4 (4–15 Gm.).

7. *Sodii Santoninas. Sodium Santoninate,* $2NaC_{15}H_{19}O_4,7H_2O$, official 1880–1910.—Obtained by heating solution of sodium hydroxide 100 Ml. (Cc.), water 30 Ml. (Cc.), santonin 30 Gm., until dissolved, filtering, crystallizing. It is in fine felt-like crystals (prisms), inodorous, saline, bitter, alkaline reaction; soluble in water (3), alcohol (12). Anthelmintic; lumbricoid worms. Should be kept dark, in amber-colored, well-stoppered vials. Dose, adult, gr. 5–10 (.3–.6 Gm.), twice daily; children, gr. 1–5 (.6–.3 Gm.), with sugar.

LITHIUM.

$L^i = 6.94$.

The metal lithium (Gr. λίθος, a stone—*i. e.*, dissolves these in the system, or is found among minerals) is not official, but has several salts which are. It is found sparingly as silicate in a few rare minerals, lepidolite, spodumene, amblygonite, etc., as chloride in soils and spring water, and as carbonate in plant ashes: it is the lightest metal known, resembles potassium and sodium, and, like them, ignites when thrown upon water.

Tests for Lithium Salts.—1. The volatile salts give a vivid red to colorless flame. 2. Lithium compounds in strong solutions give with ammonium carbonate a white precipitate. 3. The neutral or alkaline solutions give with sodium phosphate, on boiling, a white precipitate (Li_3PO_4), soluble in acids and ammonium salts.

Lithii Carbonas. Lithium Carbonate, Li_2CO_3.—(Syn., Lith. Carb., Carbonas Lithicus; Fr. Carbonate (de Lithine) lithique; Ger. Lithium carbonicum, Lithiumcarbonat, Lithiæ Carbonas, Kohlensaures Lithion.)

Manufacture: 1, By double decomposition between lithium chloride and ammonium carbonate, filtering, washing with alcohol, drying—$2LiCl + NH_4HCO_3 = Li_2CO_3 + NH_4Cl + HCl$; 2, Fuse together lepidolite 10 parts, barium carbonate 10, barium sulphate 5, potassium sulphate 3. The heavy barium silicate and sulphate subside, while lithium and potassium sulphates come to the surface, the mass is now lixiviated to dissolve the two latter salts, and then by double decomposition with ammonium carbonate the lithium carbonate is obtained. It is a light, white powder, odorless, alkaline taste, permanent, soluble in water (78), boiling water (140), diluted acids with effervescence, almost insoluble in alcohol; fuses at low red heat; at higher temperature loses some carbon dioxide, becoming partially lithium oxide; saturated aqueous solution alkaline; contains 98.5 p. c. of the pure salt. *Tests:* 1. Imparts crimson color to flame. 2. Mix 1 part with distilled water (20), add few drops of hydrochloric acid, with agitation until dissolved, boil, cool, render alkaline with ammonia water—no turbidity or precipitate (abs. of iron, aluminum). 2. Dissolve in 40 parts of diluted acetic acid—.15 p. c. of insoluble residue. *Impurities:* Heavy metals, iron, aluminum, other alkalies. Should be kept in well-closed containers. Dose, gr. 5–15 (.3–1 Gm.), in carbonic-acid water.

PROPERTIES AND USES.—Diuretic to remove uric acid calculi, gout, gouty diathesis, to dissolve false membrane. Best solvent for uric acid, slight depressant, renders urine alkaline.

Lithii Bromidum. Lithium Bromide, $LiBr$.—(Syn., Lith. Brom., Bromuretum Lithicum; Fr. Bromure de Lithium; Ger. Bromlithium, Lithium [bromid] bromatum.)

Manufacture: Heat solution of ferrous bromide with lithium carbonate, evaporate, crystallize—$FeBr_2 + Li_2CO_3 = 2LiBr + FeCO_3$, or can dissolve lithium carbonate in hydrobromic acid. It is a white, granular salt, odorless, sharp, slightly bitter taste, very deliquescent, soluble in alcohol, ether, water (.6), boiling water (.4); aqueous solution (1 in 20) neutral, slightly alkaline; fuses at low red heat, at higher temperature slowly volatilizes; contains 85 p. c. of the pure salt. *Tests:* 1. Imparts crimson color to flame. 2. Aqueous solution (1 in 10) with silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid or moderate excess of ammonia water. *Impurities:* Heavy metals, iron, aluminum, other alkalies, bromate, chloride, iodide, sulphate. Should be kept in air-tight containers. Dose, gr. 10–30 (.6–2 Gm.).

PREPARATION.—(Unoff.): *Elixir,* 8.5 p. c., +, dose, ʒij–4 (8–15 Ml. (Cc.)).

PROPERTIES AND USES.—This is the most hypnotic of all the bromides—epilepsy, gout, etc.

Lithii Citras. Lithium Citrate, $Li_3C_6H_5O_7 + 4H_2O$.—(Syn., Lith. Cit., Lithium Citricum; Fr. Citrate de Lithine; Ger. Citron(en)saures (Lithium) Lithion, Lithium [citrat] citricum.)

Manufacture: Neutralize solution of citric acid with lithium carbonate, evaporate, crystallize—$3Li_2CO_3 + 2H_3C_6H_5O_7 + H_2O$ + boiling in water $= 2Li_3C_6H_5O_7 + 4H_2O + 3CO_2$. It is a white powder, or in granular form, odorless, cooling, faintly alkaline taste, deliquescent in moist air, loses water of crystallization at 150° C. (302° F.), soluble in water (1.4), slightly in alcohol; aqueous solution (1 in 20) faintly alkaline to litmus but not reddened by 1 drop of phenolphthalein T. S.; chars at red heat, emits inflammable vapors of pungent odor, leaving black residue of lithium carbonate mixed with carbon; contains 98.5 p. c. of the pure salt. *Tests:* 1. Imparts crimson color to flame. 2. Boil aqueous solution (1 in 20) with equal volume of calcium chloride T. S.—white precipitate. *Impurities:* Heavy metals, other alkalies. Should be kept in air-tight containers. Dose, gr. 10–30 (.6–2 Gm.).

PREPARATION.—(Unoff.): *Elixir,* 8.5 p. c., +, dose, ʒij–4 (8–15 Ml. (Cc.)).

Allied Salts:

1. *Lithii Benzoas. Lithium Benzoate,* $LiC_7H_5O_2$, official 1880–1910. —Obtained by adding benzoic acid to a hot solution of lithium carbonate, evaporating, crystallizing—$2HC_7H_5O_2 + Li_2CO_3$ + boiling in water = $2LiC_7H_5O_2 + H_2O + CO_2$. It is a light, white powder, shining crystalline scales, faint benzoin odor, cooling sweetish taste, permanent, soluble in water (3), alcohol (13), fuses when heated, giving lithium carbonate and carbon; contains 98.5 p. c. of the pure salt. Diuretic; gout, calcarious disorders, rheumatism, but no better than citrate or carbonate. Should be kept in well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.).

2. *Sal Lithii Citratis Effervescens. Effervescent Salt of Lithium Citrate,* official 1890–1910.—Obtained by triturating together citric acid 19.5 Gm., lithium citrate 5 Gm., tartaric acid 30 Gm., incorporating sodium bicarbonate 57 Gm., heating in oven at 93–104° C. (199–219° F.), manipulating with wooden spatula until moist, rubbing through No. 6 tinned-iron sieve, drying granules at 54° C. (129° F.). Similar to lithium carbonate, being eliminated by the kidneys as such, with less irritation to the stomach, more pleasant taste, and greater solubility. Should be kept in well-stoppered bottles. Dose, ʒj–2 (4–8 Gm.), in water while effervescing, thus being rendered more palatable.

3. *Lithii Salicylas. Lithium Salicylate,* $LiC_7H_5O_3$, official 1880–1910.—Obtained by heating salicylic acid (44), lithium carbonate (12, in water (100) until effervescence ceases, filtering, evaporating—$Li_2CO_3 + 2HC_7H_5O_3 = 2LiC_7H_5O_3 + H_2O + CO_2$. It is a white, grayish-white powder, odorless, sweetish taste, deliquescent, soluble in water, alcohol, decomposed by heat, with phenol odor, leaving lithium carbonate and carbon; contains 98.5 p. c. of the pure salt. Antirheumatic; rheumatism, gout; better than sodium salicylate or salicylic acid, the latter being less soluble and more irritating to the stomach. Should be kept in well-stoppered bottles. Dose, gr. 10–30 (.6–2 Gm.), in aromatic syrup; elixir, 8.5 p. c., +.

AMMONIUM.

$NH^{i}_{4} = 18.$

There is no metallic ammonium (L. *Ammoni-a* + *um,* fr. (*sal*) *ammoniac,* obtained from near temple of Jupiter Ammon, in Libya, by burning camel's dung); the nearest approach to it, so far, being the ammonium amalgam or alloy made by dissolving potassium in mercury, and adding a strong solution of ammonium chloride, when potassium chloride and ammonium amalgam are formed, this latter being a soft spongy metallic substance readily decomposing into mercury, hydrogen, and ammonia gas. Although we have not the metal as represented in these elements thus joined, we nevertheless have many salts consisting of NH_4 in combination with various acids, all of which by physical and chemical properties resemble those of potassium, sodium, and lithium.

Tests for Ammonium Salts: 1. All compounds evolve ammonia gas when heated with calcium, potassium, or sodium hydroxide; the gas is recognized by odor, by restoring reddened litmus-paper, by dark-blue with cupric sulphate paper. 2. With platinic chloride + HCl get yellow precipitate. 3. Salts are white, volatile, and soluble in water. 4. In neutral solutions cobaltic nitrite gives yellow precipitate.

Ammonii Benzoas. Ammonium Benzoate, $NH_4C_7H_5O_2$.—(Syn., Ammon. Benz., Ammonium Benzoicum. Ammoniæ Benzoas, Benzoas Ammonicus; Fr. Benzoate d'Ammoniaque; Ger. Benzoësaures Ammon.)

Manufacture: Dissolve benzoic acid in 20 p. c. ammonia water by warming, stirring, keeping solution always alkaline, set aside to crystallize—$NH_4OH + HC_7H_5O_2 = NH_4C_7H_5O_2 + H_2O$. It is in thin, white, laminar crystals or crystalline powder, odorless or slight odor of benzoic acid, saline, bitter, acrid taste; loses ammonia on exposure, soluble in water (10), alcohol (35.5), glycerin (8); heated evolves ammonia and benzoic acid; ash .05 p. c.; aqueous solution neutral or slightly acid. *Tests:* 1. Aqueous solution (1 in 10) + ferric chloride T. S.—pink precipitate. 2. Heated with potassium hydroxide T. S. —evolves ammonia; contains 98 p. c. of the pure salt. *Impurities:* Heavy metals, etc. Should be kept cool in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.), best given in mixture.

PROPERTIES AND USES.—Stimulant, diuretic, alterative. Due to the benzoic acid, which is absorbed and eliminated by the kidneys as hippuric acid—the ammonia base as nitric acid; for defective action, solvent for phosphatic deposits (phosphaturia), cystitis, gouty affections, uric acid gravel, muscular rheumatism.

Incompatibles: Acids, ferric salts, solution potassium hydroxide.

Ammonii Bromidum. Ammonium Bromide, NH_4Br.—(Syn., Ammon. Brom.; Fr. Bromure d'Ammonium; Ger. Ammonium bromatum, Ammoniumbromid, Bromammonium.)

Manufacture: 1, Neutralize hydrobromic acid with ammonia water or carbonate, evaporate, crystallize—$HBr + NH_4OH = NH_4Br + H_2O$; 2, $2NH_4OH + FeBr_2 = 2NH_4Br + Fe(OH)_2$; 3, $(NH_4)_2SO_4 + 2KBr = 2NH_4Br + K_2SO_4$; this last method is the best. It is in colorless, transparent, prismatic crystals, white, crystalline or granular powder; odorless, pungent saline taste; somewhat hygroscopic, soluble in water (1.3), boiling water (.9), alcohol (12), boiling alcohol (1.2);

heated volatilizes without fusing. *Tests:* 1. Aqueous solution, neutral or slightly acid, heated with potassium hydroxide T. S.—evolves ammonia. 2. With silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid, or moderate excess of ammonia water. 3. Incinerate—ash .05 p. c.; contains 98.5 p. c. of the pure salt. *Impurities:* Heavy metals, iron, barium, bromate, iodide, sulphate. Should be kept in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.), ter die.

PREPARATIONS.—(Unoff.): *Elixir*, 8.5 p. c., dose, ʒj–2 (4–8 Ml. (Cc.)). *Elixir Trium Bromidorum*—Ammonium, potassium, sodium bromides, each 8 p. c., + cudbear .2, comp. elixir of almond q. s. 100.

PROPERTIES AND USES.—Like potassium bromide, but less depressing upon the arteries and muscles. Epilepsy, neurosis, delirium tremens, whooping-cough, rheumatism, menorrhagia.

Incompatibles: Acids, acid salts, spirit of nitrous ether.

Ammonii Valeras. Ammonium Valerate, $NH_4C_5H_9O_2$.—(Syn., Ammon. Valer., Ammonium Valerianate, Ammonii Valerianas; Fr. Valérianate d'Ammoniaque; Ger. Baldriansaures (Valeriansaures) Ammon, Valerianas Ammonicus.)

Manufacture: Saturate valeric acid with ammonia gas—*i. e.*, pass gas into solution of the acid until it is neutral, crystallize. It is in colorless, white quadrangular plates, odor of valeric acid, sharp, sweetish taste, deliquescent, soluble in water (.3), alcohol (.6), ether; heated—fuses giving off vapors of ammonia and valeric acid, finally volatilizes—residue .05 p. c. *Tests:* 1. Aqueous solution heated with potassium hydroxide T. S.—evolves ammonia. 2. Supersaturated aqueous solution + sulphuric acid—oily layer of valeric acid rises to the surface; composition somewhat varying. *Impurities:* Heavy metals, acetate. Should be kept in well-closed containers. Dose, gr. 2–10 (.13–.6 Gm.).

PREPARATION.—(Unoff.): *Elixir*, 3.5 p. c., + chloroform .15, ammonia water to render alkaline, +, dose, ʒj–2 (4–8 Ml. (Cc.)).

PROPERTIES AND USES.—Hysteria, epilepsy, chorea, neuralgia, nervous headache, insomnia, heart palpitation.

Ammonii Chloridum. Ammonium Chloride, NH_4Cl.—(Syn., Ammon. Chlor., Muriate of Ammonia, Ammonium (Muriaticum) Hydrochloratum Depuratum, Sal (Ammoniacum) Ammoniac, Chloruretum Ammonicum; Fr. Chlorure d'Ammonium, Sel Ammoniac, Chlorhydrate d'Ammoniaque; Ger. Ammonium chloratum, Ammoniumchlorid, Reiner Salmiak, Chlorammonium.)

Manufacture: The gas-liquor, an aqueous liquid condensed in the preparation and purification of illuminating gas from coal, contains chiefly ammonium carbonate, also sulphide, cyanide, and empyreumatic products; this liquor is distilled with lime and the generated ammonia gas passed into sulphuric acid, forming ammonium sulphate, which is then sublimed with sodium chloride—$(NH_4)_2SO_4 + 2NaCl = Na_2SO_4 + 2NH_4Cl$, or the ammonia gas may be passed directly into hydrochloric acid, forming the chloride. It is a white, crystalline, granular powder, odorless, cooling saline taste, somewhat hygroscopic, soluble in water (2.6), boiling water (1.4), alcohol (100), glycerin (8); heated volatilizes without fusing; cold aqueous solution—not immediately acid; contains 99.5 p. c. of the pure salt. *Tests:* 1. Aqueous solution (1 in 10) + silver nitrate T. S.—white curdy precipitate, insoluble in nitric acid, readily soluble in ammonia water. 2. Aqueous solution heated with potassium hydroxide T. S.—evolves ammonia. *Impurities:* Heavy metals, sulphocyanate, non-volatile substances. Dose, gr. 3–20 (.2–1.3 Gm.).

PREPARATIONS.—1. *Trochisci Ammonii Chloridi.* Troches of Ammonium Chloride. (Syn., Troch. Ammon. Chlor.; Fr. Tablettes (Pastilles) de Chlorure d'Ammonium (de Sel Ammoniac); Ger. Salmiakpastillen.)

Manufacture: Rub together until thoroughly mixed ammonium chloride 10 Gm., extract of glycyrrhiza 20 Gm., tragacanth 2 Gm., sugar 40 Gm., form mass with syrup of tolu q. s., divide into 100 troches. Dose, 1–5 troches.

Unoff. Prep.: Mistura, 2.5 p. c., + pure extract of glycyrrhiza 2.5, water q. s. 100, dose, ʒj–3 (4–12 Ml. (Cc.)).

PROPERTIES AND USES.—Stimulant, irritant, expectorant, acute and chronic bronchitis, catarrhal pneumonia, jaundice, hepatic torpor and engorgement, glandular enlargements, hemicrania, dysmenorrhœa, ovaralgia, sciatica, prostate enlargement, amenorrhœa, uterine tumors, stomach hemorrhage, diabetes, rheumatism, snake-bites, contusions, tumors, ulcers, leucorrhœa, gonorrhœa, gangrene, chronic catarrh; in gargles, dentifrices, errhine powders; disagreeable taste may be disguised by elixir, syrup, or fluidextract of licorice.

Incompatibles: Cardiac depressants, alkalies, alkaline earths and their carbonates, tartaric and mineral acids, soluble lead and silver salts.

Synergists: Expectorants, emetics, diaphoretics.

Ammonii Carbonas. Ammonium Carbonate, $NH_4HCO_3,NH_4NH_2CO_2$.—(Syn., Ammon. Carb., Ammoniæ Sesquicarbonas, Carbonas Ammonicus, Volatile Salt, Sal Volatile (Siccum), Alkali Volatile; Fr. Sel volatile d'Angleterre, Alcali volatil concret, Carbonate d'Ammoniaque; Ger. Ammonium carbonicum, Ammoniumcarbonat, Kohlensaures Ammonium, Flüchtiges Laugensalz, Reines Hirschhornsalz.)

Manufacture: Heat to redness (sublime) 1 part ammonium chloride (sal ammoniac) + 2 calcium carbonate (chalk), or 4 parts each ammonium sulphate and chalk + 1 charcoal, passing vapors into leaden chambers to condense—$4NH_4Cl + 2CaCO_3 = NH_4HCO_3.NH_4NH_2CO_2 + 2CaCl_2 + NH_3 + H_2O$; the ammonia is utilized by passing it into water or dilute sulphuric acid, and ammonia sulphate is used mostly on account of cheapness. This carbonate is not normal, $(NH_4)_2CO_3$, but is a double salt, one molecule being acid or bi-ammonium carbonate, and one being ammonium carbamate (carbonate deprived of H_2O); the latter dissolved in water soon becomes neutral ammonium carbonate—$NH_4NH_2CO_2 + H_2O = (NH_4)_2CO_3$. If exposed to air, gradually loses ammonia and carbon dioxide, becoming an opaque white powder of acid or bi-ammonium carbonate, NH_4HCO_3. The salt may also be obtained by washing the powdered official carbonate with a little cold water, which dissolves mainly the carbamate, leaving the bicarbonate undissolved. It is in white, hard, translucent, striated masses, strong odor of ammonia, without empyreuma, sharp ammoniacal taste, soluble in water (4); decomposed by hot water eliminating carbon dioxide and ammonia, completely volatilized by prolonged boiling; alcohol dissolves the carbamate, leaving the acid carbonate; on exposure loses carbon dioxide and ammonia, becoming opaque and finally porous lumps or white powder; contains varying proportions of the mixed salts, and should yield 30–32 p. c. of ammonia gas. *Tests:* 1. When heated—volatilizes without charring, vapor being alkaline, and residue .05 p. c. 2. Aqueous solution (1 in 20) alkaline—effervesces with acids. *Impurities:* Heavy metals, chloride, sulphate, thiosulphate, empyreumatic substances. Should be kept cool in well-closed containers, and when for medicinal purposes, use only the translucent portions. Dose, stimulant, expectorant, gr. 2–3 (.13–.2 Gm.); for fevers, gr. 5–15 (.3–1 Gm.), in solution.

PREPARATIONS.—1. *Liquor Ammonii Acetatis.* Solution of Ammonium Acetate. (Syn., Liq. Ammon. Acet., Spirit of Mindererus; Fr. Acétate d'Ammoniaque liquide, Esprit de Mindérérus; Ger. Liquor Ammonii acetici, Ammoniumacetatlösung.)

Manufacture: Add ammonium carbonate (in hard, translucent pieces, free from white, pulverulent bicarbonate) 5 Gm., gradually, to cold diluted acetic acid 100 Ml. (Cc.), stir until dissolved. It is a clear, colorless aqueous liquid, free from empyreumatic odor, mildly saline, acidulous taste, acid reaction; volatile when heated; evaporate 20 Ml. (Cc.), ignite residue—ash .003 Gm.; contains 7 p. c. of ammonium acetate, $NH_4C_2H_3O_2$, with small amounts of acetic and carbonic acids. *Tests:* 1. Heat with potassium hydroxide T. S.—ammonia evolved. 2. To 5 Ml. (Cc.) add sulphuric acid and alcohol, each 1 Ml. (Cc.), boil—ethyl acetate formed, recognized by odor; must not be dispensed unless recently prepared. Dose, ʒij–4 (8–15 Ml. (Cc.)).

Prep.: 1. *Liquor Ferri Ammonii Acetatis,* 50 p. c. 2. *Elixir Ferri, Quininæ et Strychninæ Phosphatum,* .9 p. c. 3. *Spiritus Ammoniæ Aromaticus,* 3.4 p. c.

Unoff. Preps.: Mistura Pectoralis, Stokes, 1.75 p. c., + fldext. of senega 3.5, fldext. of squill 3.5, camph. tinct. of opium 17.5, water 8.5, syrup of tolu q. s. 100, dose, ʒj–2 (4–8 Ml. (Cc.)). *Liquor Ammonii Citratis* (Br.), 8.75 p. c., dose, ʒij–6 (8–24 Ml. (Cc.)).

PROPERTIES AND USES.—Cardiac stimulant, expectorant, rubefacient, irritant poison; pneumonia, bronchitis, phthisis, hysteria, syncope, typhus and typhoid fevers, scarlatina, measles, erysipelas, bites of venomous serpents, diabetes, headache, nervous spasms, faintness.

Incompatibles: Cardiac sedatives, acids, acid salts, lime water.

Synergists: Cardiac and diffusible stimulants, antispasmodics, capsicum; locally—cantharides, counter-irritants.

Ammonii Salicylas. Ammonium Salicylate, $NH_4C_7H_5O_3$.—(Syn., Ammon. Salicyl.; Fr. Salicylate d'Ammoniaque; Ger. Ammonium salicylicum, Ammoniumsalicylat, Salicylsaures Ammon.)

Manufacture: Dissolve salicylic acid (10) in 10 p. c. ammonia water (12), evaporate to dryness. It is in colorless, lustrous, monoclinic prisms or plates, or white, crystalline powder, odorless, saline, bitter, sweetish after-taste, permanent, soluble in water (1), alcohol (3), fuses with decomposition, emitting inflammable vapors and odor of phenol, finally volatilizes—ash .1 p. c.; contains 98 p. c. of the pure salt. *Tests:* 1. Aqueous solution (1 in 10) colorless, neutral, slightly acid; heated with potassium hydroxide T. S.—evolves ammonia; with few drops of ferric chloride T. S.—dark red, precipitate (if strong), violet-blue (if weak). 2. Concentrated aqueous solution + diluted hydrochloric or sulphuric acid—voluminous white precipitate. *Impurities:* Heavy metals, etc. Should be kept cool, dark, in well-closed containers. Dose, gr. 2–10 (.13–.6 Gm.).

Properties and Uses.—Antirheumatic, antipyretic, expectorant, germicide; febrile conditions, bronchitis, rheumatism, gout, etc.

Ammonii Iodidum. Ammonium Iodide, NH_4I.—(Syn., Ammon. Iod., Ioduretum Ammonicum; Fr. Iodure d'Ammonium; Ger. Jod Ammonium, Ammonium (jodid) jodatum.)

Manufacture: Dissolve in boiling water ammonium sulphate (2), potassium iodide (2.5), stir well, cool, add alcohol (1) to insure separation of potassium sulphate, evaporate filtrate to dryness, stirring constantly—$(NH_4)_2SO_4 + 2KI = 2NH_4I + K_2SO_4$. It is in minute, colorless, cubical crystals, white granular powder, odorless, sharp saline taste, very hygroscopic, on exposure soon becoming yellow, yellowish-brown, from loss of ammonia and liberation of iodine, soluble in water (.6), boiling water (.5), alcohol (3.7), glycerin (1.5); contains 99 p. c. of the pure salt. *Tests:* 1. Heat strongly—evolves vapor of iodine, volatilizes without fusing, residue .1 p. c. 2. Aqueous solution (1 in 20) neutral or slightly acid; heated with potassium hydroxide—evolves ammonia; + few drops of ferric chloride T. S. —liberates iodine, imparting violet color to chloroform when shaken with it. *Impurities:* Heavy metals, iron, barium, free iodine. Should be kept dark, in small, well-closed containers. Dose, gr. 2–15 (.13–1 Gm.), in water, syrup; ointment (5–10 p. c.); used externally.

Preparation.—(Unoff.): *Liniment*—iodine .4, ammonia water 11, oils of rosemary and lavender, each 1.5, camphor 3.2, alcohol q. s. 100.

Properties and Uses.—Resolvent—resembles potassium iodide very much; secondary syphilis, chronic rheumatism, incipient phthisis, scrofula, enlarged tonsils, lepra, psoriasis, Tinea capitis, enlarged glands.

Allied Salts:

1. *Ammonii Nitras. Ammonium Nitrate,* NH_4NO_3.—Obtained by (1) neutralizing nitric acid with ammonia water or ammonium carbonate, filtering, evaporating—$NH_4HCO_3,NH_4NH_2CO_2 + 3HNO_3 = 3NH_4NO_3 + H_2O + 2CO_2$; (2) neutralizing gas-liquor with HNO_3

instead of HCl; (3) double decomposition between ammonium sulphate and potassium nitrate. It is in colorless, hexagonal prisms, or long, flexible, thread-like needles, or fused masses, odorless, sharp, bitter taste, soluble in water (.5), alcohol (20), deliquescent, detonates, hence should be kept in well-stoppered bottles; contains as impurities chloride, sulphate. Properties and uses very similar to those of potassium nitrate, but occasions less cardiac depression; important as the source of *nitrous oxide* (*gas*), see page 66 . Dose, gr. 1–20 (.06–1.3 Gm.).

2. *Ammonii Phosphas. Ammonium Phosphate,* $(NH_4)_2HPO_4$, official 1880–1890. Obtained by adding strong solution of ammonia to diluted phosphoric acid until alkaline; evaporate, adding ammonia water occasionally to preserve alkalinity; dry crystals quickly. It is in transparent, colorless, monoclinic crystals, white crystalline powder, sp. gr. 1.678, odorless, cooling, saline taste, efflorescent, soluble in water (4), insoluble in alcohol, volatile. Gout, rheumatism, diabetes. Dose, gr. 10–20 (.6–1.3 Gm.), ter die.

3. *Ammonii Sulphas. Ammonium Sulphate,* $(NH_4)_2SO_4$, official 1870–1890. Obtained from coal-gas liquor by mixing it with lime, distilling off ammonia, catching it in sulphuric acid; usually contains sulphocyanate, NH_4CNS, etc.; a pure salt is prepared by neutralizing diluted sulphuric acid with ammonia water, crystallizing. It is in colorless, transparent, rhombic prisms, odorless, sharp, saline, bitterish taste, permanent, soluble in water (1.3), slightly in alcohol, decomposed by heat. *Impurities:* Iron, lead, chloride, sulphocyanate. Not used in medicine, but in the manufacture of ammonia water, ammonium chloride, ammonia alum, and sulphate of iron and ammonium.

4. *Ammonii Hypophosphis. Ammonium Hypophosphite,* $NH_4H_2PO_2$.—Obtained by double decomposition between solutions of calcium hypophosphite and sodium carbonate. It is in colorless, hexagonal plates, granular powder, odorless, saline, bitter taste, soluble in water (1), alcohol (20). Dose, gr. 3–5 (.2–.3 Gm.); syrup, 3.5 p. c., + dil. hypophosphorous acid .2, ʒj–2 (4–8 Ml. (Cc.)).

MAGNESIUM.

Mg^{ii} 24.32.

The element magnesium (L. *magnesi*(*a*) + *um,* district in Thessaly; also name of two cities in Asia Minor) occupies an intermediate place between metals of the alkalies and alkaline earths, with which latter it once was classed, but now has been separated, owing to its closer recognized analogies to zinc, both having volatile chlorides, soluble sulphates, and isomorphous salts. Magnesium occurs abundantly in nature as chloride and sulphate, in Stassfurt salt-mines, also in numerous spring waters; as carbonate in magnesite; as magnesia calcic carbonate in dolomite (magnesia lime-stone), which is so profuse in places as sometimes to form the greater bulk of mountain ranges; as silicate in asbestos, meerschaum, serpentine, soapstone, talc, etc.

The metal is obtained by the action of metallic sodium on magnesium chloride—$MgCl_2 + 2Na = 2NaCl + Mg$. It is silver-white, losing lustre by oxidization; when heated to redness yields brilliant white light, and MgO; like potassium and sodium, decomposes hot water —$Mg + 2H_2O = Mg(OH)_2 + 2H$. It is not official, but several of its important salts are.

Tests for Magnesium Salts: 1. With caustic alkalies get gelatinous, white precipitates, insoluble in excess, but soluble in ammonium chloride. 2. With potassium or sodium carbonate + heat get white precipitate of basic carbonate, $4MgCO_3,Mg(OH)_2$. 3. With sodium phosphate + ammonium chloride and ammonia get white crystalline precipitate of magnesium-ammonium phosphate, $MgNH_4PO_4$. 4. Salts are white and soluble, except carbonate, phosphate, arsenate; oxide and hydroxide also are insoluble, the latter being precipitated by $NaOH$ or KOH.

Magnesii Sulphas. Magnesium Sulphate, $MgSO_4 + 7H_2O$.—(Syn., Mag. Sulph., Epsom Salt, Sal Amarum—Epsomense—Anglicum or Sedlicense, Sulfas Magnesicus; Fr. Sulfate de Magnésie, Sel d'Epsom, Sel (amer) de Sedlitz; Ger. Magnesium sulfuricum, Magnesiumsulfat, Schwefelsaure Magnesia, Bittersalz.)

Manufacture: 1, Chiefly obtained from Stassfurt, as kieserite ($MgSO_4,H_2O$); heat mineral, dissolve in water, crystallize; 2, By dissolving magnesite (native ($MgCO_3$)) in diluted sulphuric acid, filtering, crystallizing—$MgCO_3 + H_2SO_4 = MgSO_4 + H_2O + CO_2$; 3, By heating dolomite ($MgCO_3,CaCO_3$) to dissipate CO_2, treating residue with HCl to take up calcium, and dissolving the remaining magnesium in H_2SO_4. It is in small, colorless, prismatic needles or rhombic prisms, odorless, cooling, saline, bitter taste, slowly efflorescent, soluble in water (1), boiling water (.2), almost insoluble in alcohol; aqueous solution (1 in 20) neutral; exposed to warm air loses some water of crystallization, forming a white powder, further heating removes more water, and above 200° C. (392° F.) becomes anhydrous; contains 48.59–53.45 p. c. of anhydrous magnesium sulphate, corresponding to 99.5 p. c. of the crystallized salt. *Tests:* 1. Aqueous solution (1 in 20) with ammonium chloride T. S., ammonia water, and sodium phosphate T. S.—white, crystalline precipitate; 2. Aqueous solution with barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. *Impurities:* Heavy metals, arsenic, chloride. Should be kept in well-closed containers. Dose, ℥ss–1 (15–30 Gm.), in cold water or effervescing solution.

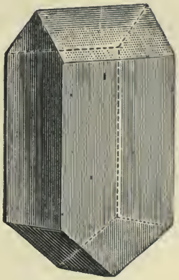


Fig. 458.—Magnesium sulphate crystal.

Preparations.—1. *Infusum Sennæ Compositum,* 12 p. c.

Unoff. Preps.: Liquor Magnesii Sulphatis Effervescens, 25 Gm., + citric acid 4, syrup of citric acid 60, potassium bicarbonate 2.5, dist.

water q. s. 100, dose, the entire contents of bottle. *Magnesii Sulphas Effervescens*, 50 p. c.

PROPERTIES AND USES.—Cathartic, producing safe, painless, watery stools, refrigerant, diuretic; fevers, inflammatory affections, colic, constipation, dysentery, septic fever, intestinal obstruction, pleurisy, painter's (lead, barium) colic.

Incompatibles: Alkaline carbonates, lime water, phosphoric acid, phosphates, lead acetate, silver nitrate.

Magnesii Carbonas. Magnesium Carbonate, $(MgCO_3)_4, Mg(OH)_2 + 5H_2O$.—(Syn., Mag. Carb., Carbonicas Magnesicus, Magnesia (Alba) Hydrico-carbonica; Br. Magnesii Carbonas Levis; Fr. Carbonate de Magnésie, Magnésie blanche; Ger. Magnesium carbonicum, Basisches Magnesiumcarbonat, Kohlensaure Magnesia, Weisse Magnesia.)

Manufacture: Mix strong boiling aqueous solutions of magnesium sulphate and sodium carbonate, wash precipitate to remove sodium chloride, dry without heat—$5(MgSO_4 + 7H_2O) + 5(Na_2CO_3 + 10H_2O) = [(MgCO_3)_4 + Mg(OH)_2 + 5H_2O] + 5Na_2SO_4 + CO_2 + 79H_2O$. If a heavier salt is desired (for heavy magnesium oxide), digest the salts in water and evaporate to dryness without filtering, then lixiviate the mass with water to wash out Na_2SO_4, leaving magnesium salt to be dried. It is in light, white, friable masses, bulky white powder, odorless, slight, earthy taste, permanent, practically insoluble in alcohol, water, but imparts to it slight alkalinity, soluble in dilute acids with effervescence; strongly heated loses water and carbon dioxide, forming magnesium oxide; contains hydrated magnesium carbonate and magnesium hydroxide, corresponding to 39.2 p. c. of magnesium oxide and .8 p. c. of calcium oxide. *Tests:* 1. Dissolve in diluted hydrochloric acid, add ammonium chloride T. S., an excess of ammonia water, and sodium phosphate T. S.—white crystalline precipitate. *Impurities:* Heavy metals, iron, calcium oxide, soluble salts. Dose, antacid, gr. 5–20 (.3–1.3 Gm.); laxative, ʒss–1 (2–4 Gm.), in water, milk.

PREPARATIONS.—1. *Magma Magnesiæ.* Magnesia Magma. (Syn., Magma Mag., Milk of Magnesia; Fr. Lait de Magnésie; Ger. Magnesiamilch.

Manufacture: Mix magnesium carbonate 12.5 Gm. with enough distilled water (50 Ml. (Cc.)) for smooth mixture; dissolve sodium hydroxide 8 Gm. in distilled water 40 Ml. (Cc.), and add it to the magnesia mixture, constantly stirring, agitate frequently for 15 minutes, wash resulting magma, by decantation, several times, each with distilled water 200 Ml. (Cc.)—until red color produced in 5 Ml. (Cc.) of the washings by .3 drop of phenolphthalein T. S. is discharged by .1 drop of diluted sulphuric acid; allow precipitate to subside until it measures 100 Ml. (Cc.), decant supernatant liquid, transfer to wide-mouthed bottle, tightly stopper with cork dipped in melted paraffin. For the distilled water may substitute water boiled with powdered magnesium carbonate (.5 Gm. in each 100 Ml. (Cc.)) and filtered; may add, if desired, oil of peppermint or oil of anise .05 Ml. (Cc.), or other suitable flavoring. It is a thick, white, alkaline liquid consisting of magnesium hydroxide suspended in water; contains 6.5–7.5 p. c. of magnesium hydroxide, $Mg(OH)_2$. *Tests:* Add to 1 Ml. (Cc.) diluted hydrochloric acid 2 Ml. (Cc.)—few isolated bubbles, solution slightly turbid; add ammonium chloride .5 Gm., filter, render alkaline with ammonia water—no precipitate, but upon adding sodium phosphate T. S.—white precipitate. Dose, ʒj–2 (4–8 Ml. (Cc.)).

Properties and Uses.—Antacid, mild laxative; valuable for children as well as adults.

Unoff. Preps.: Liquor Magnesii Bicarbonatis, Fluid Magnesia (Br.), 2 p. c. Dose, ℥j–2 (30–60 Ml. (Cc.)). *Mistura Carminatava* (Dalby's), 6.5 p. c., + potassium carbonate .3, tinct. opium 2.5, oils of caraway, fennel, peppermint, each .05, syrup 16, water q. s. 100. *Mistura Magnesiæ, Asafœtidæ et Opii* (Dewees' Carminative) 5 p. c., + tinct. asafetida 7.5, tinct. opium 1, sugar 10, water q. s. 100.

Properties and Uses.—Antacid, cathartic, antilithic; heartburn, dyspepsia, pregnant vomiting, nauseated stomach with acidity, excessive uric acid secretion, warts, gout; where potassium and sodium salts disagree; externally as a dusting powder in intertrigo, etc., as a cosmetic.

Magnesii Oxidum. Magnesium Oxide, MgO.—(Syn., Mag. Oxid., Magnesia, Calcined Magnesia, Light Magnesia, Light Magnesium, Magnesia Calcinata; Br. Magnesia Levis; Fr. Magnésie, Magnésie calcinée; Ger. Magnesia usta, Gebrannte Magnesia.)

Manufacture: Heat official magnesium carbonate to low redness; water and carbon dioxide escape, leaving magnesium oxide—$4(MgCO_3)$, $Mg(OH)_2$, $5H_2O$ + red heat = $5MgO + 6H_2O + 4CO_2$. It is a white very bulky, fine powder, odorless, earthy but not saline taste, on exposure slowly absorbs moisture and carbon dioxide, insoluble in alcohol, almost so in water, soluble in dilute acids; contains not more than 10 p. c. of water, and after ignition, 96 p. c. of magnesium oxide, 2 p. c. of calcium oxide. *Tests:* 1. Dissolve in diluted hydrochloric acid, add ammonium chloride T. S., an excess of ammonia water, sodium phosphate T. S.—white crystalline precipitate. *Impurities:* Heavy metals, iron, soluble salts, carbonate, water. Should be kept in well-closed containers. Dose, antacid, gr. 5–20 (.3–1.3 Gm.), after meals; purgative, ʒss–1 (2–4 Gm.), added to milk or water; infants, gr. 4 (.26 Gm.).

Preparations.—1. *Extracts*—as a diluent and dryer. 2. *Ferri Hydroxidum cum Magnesii Oxido*, 1 p. c. 3. *Fluidextractum Cascaræ Sagradæ Aromaticum*, 12.5 p. c. 4. *Pulvis Rhei Compositus*, 65 p. c.

Properties and Uses.—Like the carbonate; antacid, laxative; dyspepsia, nauseating headache, gout, gravel, heartburn, flatulence, sour eructation, diarrhœa, aphthæ, hemorrhoids, infantile colic, warts, ulcers, abrasions.

Magnesii Oxidum Ponderosum. Heavy Magnesium Oxide, MgO.—(Syn., Mag. Oxid. Pond., Heavy Magnesia, Magnesia Ponderosa, Heavy Calcined Magnesia; Fr. Magnésie Calcinée pesante; Ger. Schwere gebrannte Magnesia.)

Manufacture: Same process as magnesium oxide, except here the heavy carbonate is heated instead of the light carbonate, may triturate magnesium oxide with alcohol for some time, dry and pulverize. It is a white, dense, very fine powder; three and a half times heavier than magnesium oxide, and does not, like that, unite readily with water to form gelatinous hydroxide. Should be kept in well-closed containers. Dose, gr. 5–40 (.3–2.6 Gm.).

Liquor Magnesii Citratis. Solution of Magnesium Citrate.—(Syn., Liq. Mag. Cit.; Fr. Limonade au Citrate de Magnésie, Limonade purgative Citro-magnésienne; Ger. Magnesiumcitratlösung, Flüssige Citronensaure Magnesia.)

Manufacture: Dissolve citric acid 33 Gm. in hot water 150 Ml. (Cc.), add magnesium carbonate 15 Gm., previously mixed with water 100 Ml. (Cc.), stir until dissolved, add syrup 60 Ml. (Cc.), heat to 100° C. (212° F.), add immediately oil of lemon .1 Ml. (Cc.), previously triturated with purified talc 5 Gm., filter, while hot, into a strong bottle, add boiled water q. s. 350 Ml. (Cc.); stopper with purified cotton until cold, drop in potassium bicarbonate 2.5 Gm., immediately stopper securely; shake bottle occasionally until dissolved; contains in each 100 Ml. (Cc.) magnesium citrate corresponding to 1.5 Gm. of magnesium oxide. *Impurities:* Tartaric acid, sulphate. Should be kept cool, preferably in a refrigerator, with bottle on its side. Dose, for purge, 1 bottle; as a laxative, $\frac{1}{2}$ bottle.

Allied Salts:

1. *Magnesii Sulphas Effervescens. Effervescent Magnesium Sulphate,* official 1900–1910.—Obtained by heating slowly magnesium sulphate, crystals, 50 Gm. until it ceases to lose weight, pulverizing, mixing with citric acid 13.6 Gm., tartaric acid 21.1 Gm., sodium bicarbonate 40.3 Gm., heating in oven at 93–104° C. (199–219° F.), manipulating with wooden spatula until moist, rubbing through No. 6 tinned-iron sieve, drying granules at 54° C. (129° F.). Similar to magnesium sulphate. Should be kept in well-stoppered bottles. Dose, ʒij–8 (8–30 Gm.).

2. *Magnesii Carbonas Ponderosus. Heavy Magnesium Carbonate* (Br.). Dissolve magnesium sulphate 125 Gm. and sodium carbonate 150 Gm., each in water 250 Ml. (Cc.), mix solutions, evaporate to dryness, digest residue for half an hour with distilled water 500 Ml. (Cc.), collect insoluble matter on calico filter, wash out with distilled water soluble sodium sulphate, dry. Dose, gr. 5–60 (.3–4 Gm.).

3. *Magnesii Citras Effervescens. Effervescent Magnesium Citrate.* —Obtained by mixing magnesium carbonate 10 Gm. + citric acid 30 Gm. with distilled water 4 Ml. (Cc.), drying, powdering, mixing with sugar 8 Gm., sodium bicarbonate 34 Gm., citric acid 16 Gm., moistening with alcohol, rubbing through No. 6 tinned-iron sieve. It is a white, coarsely granular salt, odorless, mild acid, refreshing taste, deliquescent, soluble with effervescence in 2 parts water, insoluble in alcohol. *Impurities:* Tartrate, etc.; should be kept in well-closed

vessels. Similar to liquor magnesii citratis, being more portable but not so pleasant. Dose, ʒj–3 (4–12 Gm.).

4. *Magnesii Chloridum. Magnesium Chloride,* $MgCl_2$.—Obtained by acting on magnesium carbonate with diluted hydrochloric acid, evaporating. It is in colorless, transparent crystals, white, translucent pieces, deliquescent, soluble in water (.6), alcohol. Dose, ʒij–6 (8–24 Gm.).

CALCIUM.

$Ca^{ii} = 40.$

The element calcium (L. *calx, calcis,* limestone, Gr. χάλιξ) is one of a group of three—calcium, barium, strontium—which form the alkaline earths. These metals, like the alkalies and magnesium, decompose water, liberating hydrogen; metallic calcium is light, yellow, ductile like gold, malleable; seldom met with except as the native salts, which are very abundant. The carbonate occurs in calc-spar, chalk, limestone, marble, shells of eggs, mollusca, etc.; acid carbonate in water; sulphate in alabaster, gypsum, bones; phosphate in apatite, animal bone, etc.; fluoride in fluorspar; chloride in water; silicate in rocks of various kinds.

Tests for Calcium Salts: 1. With soluble salts the alkaline carbonates give white precipitates, insoluble in excess. 2. With ammonium or potassium oxalate we get a white precipitate, insoluble in acetic but soluble in hydrochloric acid. 3. With sulphuric acid or KOH or NaOH get white precipitates in strong calcium solutions, but not in diluted solutions. 4. Give reddish-yellow color to flame.

Calx. Calcium Oxide, CaO.—(Syn., Lime, Quicklime, Burned Lime, Calcaria, Calx Viva, Calx Usta, Oxydum Calcicum, Calcium Oxide; Fr. Chaux (vive); Ger. Calcaria usta, Gebrannter Kalk, Ätzkalk, Kalk.)

Manufacture: By calcining white marble or the purest varieties of native calcium carbonate—$CaCO_3 + \text{heat} = CaO + CO_2$. It is in hard, white, grayish-white masses, granules, or white powder, odorless, caustic taste, soluble in water (840), boiling water (1740), glycerin, syrup, insoluble in alcohol; moistened with water becomes heated and gradually converted into a white powder (calcium hydroxide, slaked lime), which mixed with water (3–4) forms smooth magma (milk of lime); agitated with water alkaline; contains 95 p. c. of the salt, and on ignition loses not more than 10 p. c. *Tests:* 1. Mix 5 Gm., after slaking, with distilled water 100 Ml. (Cc.), + few drops of hydrochloric acid, agitate until dissolved, boil, cool—should be acid, and not more than .05 Gm. of insoluble matter should deposit. 2. Neutralize a portion of this solution with ammonia water, + ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. *Impurities:* Carbonate, volatile substances. Should be kept dry, in air-tight containers.

Preparations.—1. *Liquor Calcis.* Solution of Calcium Hydroxide. (Syn., Liq. Calc., Lime Water, Aqua Calcis, Solution of Lime, Calcaria Solutum; Fr. Eau (Liqueur) de Chaux; Ger. Aqua Calcariæ, Kalkwasser.) *Manufacture:* This aqueous solution (saturated) is prepared by slaking lime 50 Gm., with distilled water 1000 Ml. (Cc.), gradually added, agitating occasionally for half an hour, allowing particles to subside, decanting and rejecting supernatant liquid; transfer magma to a filter, wash repeatedly with boiling distilled water until only faint cloudiness with silver nitrate T. S. (abs. of chloride), return magma to suitable container, add distilled water 5000 Ml. (Cc.), agitate thoroughly, let stand 24 hours, agitate, let coarse particles subside, pour liquid, holding undissolved calcium hydroxide in suspension, into tightly-stoppered bottle, shake occasionally to insure saturation; pour off clear liquid as required; undissolved calcium hydroxide must not be used for making additional quantities of this solution unless it should assay full strength. It is a clear, colorless, odorless liquid, alkaline taste and reaction; contains .14–.17 p. c. of calcium hydroxide—stronger when cold. *Tests:* 1. Absorbs carbon dioxide from the air, forming on its surface a pellicle of calcium carbonate. 2. Heat produces turbidity, due to separation of calcium hydroxide, which redissolves on cooling. *Impurities:* Alkalies, alkali carbonates. Dose, ℥ss–4 (15–120 Ml. (Cc.)).

Prep.: 1. *Linimentum Calcis.* Lime Liniment. (Syn., Lin. Calc., Carron Oil; Fr. Liniment (Savon) calcaire; Ger. Kalkliniment.) *Manufacture:* 50 p. c. Mix by agitation lime water and linseed oil, each 50 Ml. (Cc.); used externally.

Unoff. Preps.: Liquor Calcis Saccharatus (Br.), calcium hydroxide 5 p. c., sugar 10, water q. s. 100, dose, ♏xv–60 (1–4 Ml. (Cc.)). *Liquor Calcis Sulphuratæ*, calcium oxide 16.5 p. c., + sublimed sulphur 25, water q. s. 100. *Syrupus Calcis*, official 1880–1910, lime 6.5 p. c., sugar 35, water q. s. 100, dose, ♏xv–60 (1–4 Ml. (Cc.)).

Properties and Uses.—Lime—escharotic, depilatory, antacid, arrests putrefaction, hence added to stools of dysentery, cholera, typhoid fever, cesspools, sewers, ulcers, favus, psoriasis; Liquor—astringent, antacid; diarrhœa, diabetes, gravel, dyspepsia, scabies, Tinea capitis, ulceration of bladder, urethra, mucous and purulent discharges, ascarides of the rectum, chronic bronchitis, vomiting, nausea, prevents milk curdling in stomach, aphthæ, thrush, typhoid fever, phthisis, rachitis, cutaneous eruptions, antidote to arsenic trioxide; Liniment—burns, scalded throat, etc.; Syrup—acute rheumatism, infantile diarrhœa, vomiting, urinary affections.

Calx Chlorinata. Chlorinated Lime.—(Syn., Calx Chlorin., Chloride of Lime (misnomer), Calx Chlorata, Calcium Hypochlorite, Bleaching Powder, Oxymuriate of Lime, Chloris Calcicus, Chloruretum Calcis, Calcis Chloridum, Calcii Hypochloris; Fr. Chlorure de Chaux, Poudre de Tennant ou de Knox; Ger. Calcaria chlorata, Chlorkalk, Bleichkalk.)

Manufacture: Powdered slaked lime is spread upon shelves arranged in boxes or chambers into which from the top chlorine gas is passed as long as it is absorbed, at a temperature not above 25° C. (77° F.), to avoid formation of calcium chlorate—$2Ca(OH)_2 + 4Cl = Ca(ClO)_2 + CaCl_2 + 2H_2O$. It is a white, or grayish-white, granular powder, odor of chlorine, moist and gradually decomposed on exposure, when it should not be used or dispensed, partly soluble in water, alcohol, the insoluble portion readily settling when it is mixed with water, lumps readily break down; contains 30 p. c. of available chlorine. *Tests:* 1. Shake 1 Gm. with distilled water (50)—filtrate colors red litmus blue, then bleaches it. 2. Dissolve in diluted acetic acid—evolves abundance of chlorine, trifling residue remains undissolved; add to this solution ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. Should be kept cool, dry, in air-tight containers. Dose, gr. 1–5 (.06–.3 Gm.), in solution; mouth wash (1 p. c.); lotion (3–5 p. c.); ointment (10 p. c.).

PREPARATION.—1. *Liquor Sodæ Chlorinatæ.* Solution of Chlorinated Soda. (Syn., Liq. Sod. Chlorinat., Labarraque's Solution, Liquor Sodæ Chloratæ, Liquor Natri (Chlorati) Hypochlorosi, Bleaching Solution; Fr. Chlorure de Soude liquide, Liqueur de Labarraque; Ger. Bleichflüssigkeit, Chlornatronlösung.)

Manufacture: Triturate, until uniform, chlorinated lime 10 Gm. with water 50 Ml. (Cc.), gradually added; dissolve monohydrated sodium carbonate 7 Gm. in hot water 50 Ml. (Cc.), add this to preceding mixture, stir or shake thoroughly, and if gelatinous warm gently until liquefied, transfer to wetted muslin strainer, return liquid until clear, finally wash precipitate with water q. s. 100 Gm.; by double decomposition calcium carbonate is precipitated, while chlorinated soda and sodium chloride remain in solution—$2Na_2CO_3 + Ca(ClO)_2,CaCl_2 = 2(NaClO,NaCl) + 2CaCO_3$; hot water is used to render the precipitate, $CaCO_3$, compact, as direct heat carelessly applied might decompose solution into chloride and chlorate with evolution of oxygen. It is a clear, pale greenish, aqueous liquid (solution), faint chlorine odor, disagreeable, alkaline taste, at first colors red litmus paper blue, then bleaches it; hydrochloric acid causes evolution of chlorine and carbon dioxide; contains chlorine compounds of sodium with not less than 2.5 p. c. of available chlorine. Should be kept cool, dark, in well-stoppered bottles. Dose, ♏xxx–40 (2–2.6 Ml. (Cc.)), in water, or some mild liquid; as a gargle or injection should be diluted 8–10 times with water.

Unoff. Prep.: Liquor Calcis Chlorinatæ (Br.), 10 p. c. + water q. s. 100 (yields 3 p. c. available Chlorine.)

PROPERTIES AND USES.—Desiccant, disinfectant (one of the very best), deodorizer; ulcers, chilblains, burns, skin affections, itch, putrid sore throat, ulcerated gums, dysentery, typhus fever, scrofulous enlargements, ophthalmia, aphthæ, cancers, foul breath, mercurial salivation, antidote to hydrocyanic acid and hydrosulphuric acid. Liquor—stimulant, antiseptic, resolvent, typhus fever, scarlatina, dysentery, glandular enlargements, dyspepsia, syphilis, scrofula, carbuncles, ozæna, psoriasis, Tinea capitis, scabies, herpetic affections, smallpox, sore nipples, disinfect sick-chambers, etc.

Calcii Sulphidum Crudum. Crude Calcium Sulphide, CaS.—(Syn., Calc. Sulphid. Crud., Calx Sulphurata, Sulphurated Lime, Hepar Calcis, Hepar Sulphuris Calcareum; Fr. Sulfure de chaux; Ger. Kalkschwefelleber, Calcaria sulfurata.)

Manufacture: Heat dried calcium sulphate (70), charcoal (10), starch (2), in loosely covered crucible, to bright redness until uniform gray results—$CaSO_4 + C_3 = CaS + 2CO + CO_2$. It is a pale gray, yellowish powder, faint odor of hydrogen sulphide, nauseous, alkaline taste, gradually decomposes on exposure, soluble in solutions of ammonium salts, slightly soluble in water, more so in boiling water with partial decomposition, insoluble in alcohol; contains 55 p. c. of the salt. *Tests:* 1. Decompose with diluted acetic acid—evolves hydrogen sulphide and sometimes sulphur dioxide, residue calcium sulphate and carbon. 2. Filtered solution, + ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. Should be kept in well-closed containers. Dose, gr. $\frac{1}{10}$–$\frac{1}{2}$ (.006–.03 Gm.).

Properties and Uses.—Depilatory, itch, ringworm, acne, furuncular eruptions, buboes, leucorrhœa, rhinitis, diphtheria, rheumatism.

Calcii Chloridum. Calcium Chloride, $CaCl_2$.—(Syn., Calc. Chlor., Chloridum Calcicum, Calcium Chloratum, Calcaria (Muriatica) Hydrochlorata; Fr. Chlorure de Calcium, Hydrochlorate de Chaux; Ger. Calciumchlorid, Chlorcalcium, Salzsaures Kalk.)

Manufacture: In the crude state this is a by-product in several chemical processes, especially that for ammonia water; it may be obtained pure by neutralizing hydrochloric acid with marble or other calcium carbonate, digesting the solution with chlorinated lime and slaked lime (to precipitate iron), neutralizing filtrate with hydrochloric acid, evaporating and fusing residue at 200° C. (392° F.)—$CaCO_3 + 2HCl = CaCl_2 + H_2O + CO_2$. It is in white, slightly translucent, hard fragments, granules, sticks, odorless, sharp, saline taste, very deliquescent, soluble in water (.62), boiling water (.7), alcohol (10), boiling alcohol (2); aqueous solution (1 in 20) neutral, slightly alkaline; contains 75 p. c. of the salt. *Tests:* 1. Aqueous solution (1 in 20) + ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. 2. Aqueous solution (1 in 10) + silver nitrate T. S.—white precipitate insoluble in nitric acid, soluble in ammonia water. *Impurities:* Heavy metals, iron, aluminum, alkalies, magnesium, phosphates, etc. Should be kept in well-stoppered bottles. Dose, gr. 10–20 (.6–1.3 Gm.), in water, milk.

Properties and Uses.—Irritant—excessive doses occasion gastro-intestinal inflammation; Resolvent—glandular enlargements, scrofulous swellings, skin diseases, lupus, uterine and ovarian tumors, fibroids.

Calcii Carbonas Præcipitatus. Precipitated Calcium Carbonate, $CaCO_3$.—(Syn., Calc. Carb. Præc., Precipitated Chalk, Creta Præcipitata, Carbonas Calcicus Præcipitatus; Fr. Carbonate de Chaux précipité, Craie précipitée; Ger. Calcium carbonicum præcipitatum, Gefälltes Calciumcarbonat, Präcipitirter kohlensaurer Kalk.)

Manufacture: By double decomposition—adding to a hot solution of calcium chloride, while stirring, a solution of ammonium carbonate in excess, washing, drying precipitate, or may use sodium carbonate in place of ammonium carbonate—$CaCl_2 + Na_2CO_3 = CaCO_3 + 2NaCl$. It is a fine, white, micro-crystalline powder, odorless, tasteless, permanent, soluble with effervescence in diluted acetic, hydrochloric, or nitric acid, nearly insoluble in water, solubility increased by presence of ammonium salts, carbon dioxide, diminished by alkali hydroxides, insoluble in alcohol; heated to redness loses carbon dioxide—residue (calcium oxide); contains 98 p. c. of the salt. *Tests:* 1. Dissolve 1 Gm. in distilled water (50), using a few drops of hydrochloric acid, boil, cool—should be acid, and not more than .002 p. c. of insoluble matter should remain. 2. Neutralize a portion of this acid solution with ammonia water, + ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. *Impurities:* Heavy metals, soluble substances.

PREPARATION.—(Unoff.): *Syrupus Calcii Iodidi,* 3.4 p. c.—iodine 7.6, iron wire 2.8, sugar 70, dist. water q. s. 100, dose, ʒss–1 (2–4 Ml. (Cc.)).

PROPERTIES AND USES.—Similar to Creta Præparata, page 738.

Calcii Glycerophosphas. Calcium Glycerophosphate, $C_3H_5(OH)_2\text{-}CaPO_4 + H_2O$.—(Syn., Calc. Glycerophos., Calcium glycerino-phosphoricum; Fr. Glycerino-phosphate de Chaux; Ger. Calcium glycerinophosphat.)

Manufacture: Neutralize solution of glycerophosphoric acid with milk of lime or calcium carbonate, filter off calcium phosphate, concentrate filtrate in vacuum, precipitate with alcohol. It is a fine white powder, odorless, almost tasteless, somewhat hygroscopic, soluble in water (50), more soluble in cold water and in the presence of citric acid, insoluble in alcohol; saturated aqueous solution alkaline; this normal form contains 98 p. c. of the salt. *Tests:* 1. Cold, saturated aqueous solution heated to boiling—white, iridescent scales (anhydrous calcium glycerophosphate); decomposes at 170° C. (338° F.), evolving inflammable vapors, at red heat converted into calcium pyrophosphate. 2. Saturated aqueous solution + ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid; + lead acetate T. S.—white curdy precipitate, insoluble in nitric acid. *Impurities:* Heavy metals, chloride, phosphates, sulphate, water, alcohol-soluble substances. Should be kept in well-closed containers. Dose, gr. 5–10 (.3–.6 Gm.), in powder, water, capsule, tablet, suspended in water or syrup, or dissolved in little citric or diluted hydrochloric acid, or wine.

Preparation.—(Unoff.): *Elixir Calcii et Sodii Glycerophosphatum*, .875 p. c., + solution of sodium glycerophosphate 2.5, phosphoric acid .8, +, dose, ʒj–2 (4–8 Ml. (Cc.)).

Properties and Uses.—Nervine, tonic, where calcium and phosphate are required; phosphorus of lecithin of food is converted into glycerophosphoric acid before assimilation—the most natural form for administering phosphorus. Rachitis, neurasthenia, scrofula, difficult dentition, wasting diseases, convalescence, sciatica, incontinence of urine, diabetes.

Creta Præparata. Prepared Chalk, $CaCO_3$.—(Syn., Cret. Præp., Drop Chalk, Creta Lævigata; Fr. Craie préparée, Craie Lavée; Ger. Präparirte Kreide, Schlämmkreide.)

Manufacture: Chalk is a very abundant mineral, occurring largely on the coast of the English Channel and consisting of infinitesimal shells of foraminifera composed mostly of calcium carbonate, but having more or less silica, aluminum, iron, magnesium, and organic matter. Our official prepared chalk is this native friable $CaCO_3$, freed from most of these impurities by elutriation, which consists in washing finely powdered chalk or whiting (the latter being the deposit from the first washings of water) with cold water, allowing the coarser particles to subside, decanting the milky liquid on suitable straining cloths, collecting the moist residue and forming same into small nodules by dropping soft mass from a funnel-shaped vessel onto a drying-tray, or may be molded into crayon-sticks, and in either shape left white or tinted with various coloring substances. It is a white, grayish-white, very fine, amorphous powder, conical drops, odorless, tasteless, permanent, almost insoluble in water, alcohol, decomposed and dissolved by diluted acetic, hydrochloric, or nitric acid, with copious effervescence; dissolved in diluted hydrochloric acid—residue not more than 2 p. c.; contains 97 p. c. of the salt. *Tests:* 1. Dissolve .1 Gm. in diluted acetic acid 5 Ml. (Cc.), add to filtrate ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. 2. Heat to redness—loses gradually carbon dioxide, yielding calcium oxide; gypsum sometimes sold for it.

Preparations.—1. *Pulvis Cretæ Compositus.* Compound Chalk Powder. (Syn., Pulv. Cret. Co.; Fr. Poudre de Craie composée; Ger. Kreidepulver mit Gummi.)

Manufacture: Mix thoroughly prepared chalk 30 Gm., acacia 20 Gm., sugar 50 Gm. Dose, gr. 5–60 (.3–4 Gm.).

Prep.: 1. *Mistura Cretæ.* Chalk Mixture. (Syn., Mist. Cret.; Fr. Mixture avec la Craie; Ger. Kreidemixtur.)

Manufacture: Gradually add cinnamon water 40 Ml. (Cc.), water 20 Ml. (Cc.) to compound chalk powder 20 Gm. in a mortar, triturate until uniform, transfer to graduated vessel, rinse mortar with water q. s. 100 Ml. (Cc.), mix thoroughly. Must not be dispensed unless recently prepared. Dose, ʒj–4 (4–15 Ml. (Cc.)).

2. *Hydrargyrum cum Creta*, 57 p. c., + mercury 38 p. c.

Unoff. Preps.: Troches, $3\frac{3}{4}$ gr. (.24 Gm.). *Pulvis Cretæ Aromaticus*, 25 Gm., + Saigon cinnamon 8, myristica 6, clove 3, cardamom seed 2, sugar 56, dose, gr. 15–60 (1–4 Gm.). *Pulvis Cretæ et Opii Aromaticus*—arom. powder of chalk 97.5, opium 2.5, dose, gr. 10–60 (.6–4 Gm.).

PROPERTIES AND USES.—Mainly in tooth powders, etc.; the precipitated is considered best for such preparations, as it is finer and contains no grit; the prepared is preferable for chalk mixtures, face and toilet powders, from its more adhesive properties, dusting powder to ulcers, burns, abrasions; antidote to oxalic acid poisoning; the troches used as a mild astringent, antacid in diarrhœa, gastric acidity (preceded by a purge), being well adapted for children; the mixture for diarrhœa, loose bowels of infants, etc.

Incompatibles: Acids and sulphates.

Calcii Bromidum. Calcium Bromide, $CaBr_2$.—(Syn., Calc. Brom.; Fr. Bromure de (Chaux) Calcium; Ger. Bromcalcium, Calcium (bromid) bromatum.)

Manufacture: Dissolve pure calcium carbonate in hydrobromic acid, filter, evaporate to dryness—$CaCO_3 + 2HBr = CaBr_2 + H_2O + CO_2$; or by boiling milk of lime with ammonium bromide. It is a white granular salt, odorless, sharp, saline taste, very deliquescent, soluble in water (.7), boiling water (.4), alcohol (1.3), insoluble in chloroform, ether; aqueous solution (1 in 20) neutral, slightly alkaline; this hydrated form contains 84 p. c. of the salt. *Tests:* 1. Aqueous solution (1 in 20) + ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. 2. Aqueous solution (1 in 10) + silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid or excess of ammonia water. *Impurities:* Heavy metals, iron, alkalies, barium, magnesium, bromate, chlorides, iodide, sulphate. Should be kept in well-closed containers. Dose, gr. 10–30 (.6–2 Gm.), in water.

PREPARATION.—(Unoff.): *Elixir*, 8.5 p. c., + dil. hydrobromic acid .4, +, dose, ʒj–2 (4–8 Ml. (Cc.)).

PROPERTIES AND USES.—As a substitute for potassium bromide; hypnotic, sedative, in insomnia, hysteria, epilepsy; depresses heart less than potassium bromide.

Calcii Hypophosphis. Calcium Hypophosphite, $Ca(PH_2O_2)_2$.—(Syn., Calc. Hypophos., Hypophosphis Calcicus, Hypophosphite of Lime; Fr. Hypophosphite de Chaux; Ger. Calcium hypophosphorosum, Calcaria Hypophosphorosa, Unterphosphorigsaurer Kalk.)

Manufacture: Heat together in a deep vessel milk of lime and phosphorus, when latter dissolved filter, evaporate filtrate to dryness on water-bath, or allow to crystallize—$3Ca(OH)_2 + 8P + 6H_2O = 3Ca(PH_2O_2)_2 + 2PH_3$ (inflammable phosphine). It is in colorless, transparent, monoclinic prisms, small lustrous scales, or white crystalline powder, odorless, nauseous, bitter taste, permanent, soluble in water

(6.5), insoluble in alcohol, when heated decrepitates and decomposes, giving off water and inflammable phosphine (hydrogen phosphide), and on complete ignition leaves residue (calcium pyrophosphate); contains 98 p. c. of the salt. *Tests:* 1. Aqueous solution (1 in 20) acidulated with a few drops of hydrochloric acid, with agitation, + mercuric chloride T. S.—white precipitate (mercurous chloride), becoming gray (reduced to metallic mercury) upon the further addition of aqueous solution. 2. Aqueous solution + ammonium oxalate T. S. —white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. *Impurities:* Heavy metals, arsenic, phosphate. Should be kept in well-closed containers, and dispensed with caution, as an explosion is liable to occur when triturated or heated with nitrates, chlorates, or other oxidizing agents. Dose, gr. 5–30 (.3–2 Gm.).

PREPARATIONS.—1. *Syrupus Hypophosphitum*, 4.5 p. c.

Unoff. Preps.: Elixir Hypophosphitum—calcium hypophosphite 5.25 p. c., + sodium hypophosphite 1.75, potassium hypophosphite 1.75, hypophosphorous acid .4, +. *Elixir Hypophosphitum et Ferri*—calcium hypophosphite 1.75 p. c., sodium hypophosphite 1.75, potassium hypophosphite .875, ferric hypophosphite .875, potassium citrate 1.1, hypophosphorous acid .4, +. *Elixir Calcii Hypophosphites*, 3.5 p. c., + hypophosphorous acid .4, +. *Syrup*, 3.5 p. c., + hypophosphorous acid .15, +. *Syrupus Calcii et Sodii Hypophosphitum*, 3.5 p. c., + sodium hypophosphite 3.5, hypophosphorous acid .15, +.

PROPERTIES AND USES.—Stimulant to nervous system, chronic phthisis, scrofulous diseases, caries, chlorosis, menorrhagia, fractures, rickets, Pott's disease; possibly in the stomach converted into phosphate and absorbed as lactophosphate. In pharmacy this salt is the base of all the other hypophosphites, along with which it often is prescribed.

Calcii Lactas. Calcium Lactate, $Ca(C_3H_5O_3)_2 + 5H_2O$.—(Syn., Calc. Lact.; Fr. Lactate de chaux purifié; Ger. Calciumlactat, Milchsaurer Kalk.)

Manufacture: Neutralize hot dilute solution of lactic acid with calcium carbonate, filter, set aside to crystallize; also largely an intermediate product in preparing lactic acid. It is in white, granular masses or powder, odorless, nearly tasteless, somewhat efflorescent, anhydrous at 120° C. (248° F.), losing 25–29.2 p. c., corresponding to 5 molecules of water of crystallization, soluble in water (20), almost insoluble in alcohol; aqueous solution (1 in 20) neutral, slightly acid or alkaline; this hydrated form contains 98 p. c. of the salt. *Tests:* 1. Acidulate aqueous solution (1 in 20) with sulphuric acid, + potassium permanganate, heat—odor of acetaldehyde. 2. Aqueous solution + ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. Should be kept in well-closed containers. Dose, gr. 3–10 (.2–.6 Gm.).

PREPARATION.—1. *Syrupus Calcii Lactophosphatis.* Syrup of Calcium Lactophosphate. (Syn., Syr. Calc. Lactophos.; Fr. Sirop de

Lactophosphate (Phospholactate) de Chaux; Ger. Calciumphospholactatsirup.)

Manufacture: Mix lactic acid 6 Ml. (Cc.) with distilled water 10 Ml. (Cc.), gradually add precipitated calcium carbonate 2.5 Gm., stirring until dissolved; add phosphoric acid 3.6 Ml. (Cc.) previously diluted with distilled water 5 Ml. (Cc.), stir until precipitate first formed is dissolved, add distilled water 10 Ml. (Cc.), filter, add stronger orange flower water 5 Ml. (Cc.), glycerin 5 Ml. (Cc.), in this dissolve, by agitation, sugar 65 Gm., add distilled water q. s. 100 Ml. (Cc.), strain. Dose, ʒij–4 (8–15 Ml. (Cc.)).

Unoff. Preps.: Elixir—precip. calcium carbonate 1 p. c., + lactic acid 3, phosphoric acid 1.5, +. *Syrupus Calcii Lactophosphatis et Ferri*—ferrous lactate .85 p. c., + potassium citrate .85, water 6.25, syrup of calcium lactophosphate q. s. 100, dose, ʒj–2 (4–8 Ml. (Cc.)).

Properties and Uses.—Contains calcium in an absorbable form, and usually is combined with calcium carbonate, phosphate, or iron lactate; substitute for calcium chloride. Rachitis, scrofula, etc.; syrup of calcium lactophosphate; most palatable form—also thought to increase the coagulability of the blood.

Allied Salts:

1. *Calcii Phosphas Præcipitatus. Precipitated Calcium Phosphate,* $Ca_3(PO_4)_2$, official 1860–1910.—Obtained by dissolving bone-ash (bone calcined to whiteness in fine powder) in dilute hydrochloric acid, forming acid calcium phosphate, and calcium chloride in solution, which is poured into dilute ammonia water in excess—$Ca_3(PO_4)_2 + 4HCl = Ca(H_2PO_4)_2 + 2CaCl_2$; $Ca(H_2PO_4)_2 + 2CaCl_2 + 4NH_4OH = Ca_3(PO_4)_2 + 4NH_4Cl + 4H_2O$; a purer salt is made thus—$2Na_2HPO_4 + 3CaCl_2 + 2NH_4OH = Ca_3(PO_4)_2 + 4NaCl + 2NH_4Cl + 2H_2O$. It is a bulky, white, amorphous powder, colorless, tasteless, permanent, insoluble in alcohol, almost so in water, acetic acid; partly decomposed by boiling water as it dissolves out the acid salt, soluble in hydrochloric or nitric acid; contains 99 p. c. of pure salt. Defective nutrition, rickets (mollities ossium), scrofula, phthisis, fractures, night-sweats; in pharmacy, owing to insolubility in water, as a substitute for magnesium carbonate in making medicated waters, clarifying mixtures, etc. Dose, gr. 5–30 (.3–2 Gm.); Syrupus Calcii Hydrochlorophosphatis, 1.75 p. c., + tinct. of lemon peel 2, hydrochloric acid, water and syrup q. s., dose, ʒj–2 (4–8 Ml. (Cc.)).

2. *Calcii Sulphas Exsiccatus. Dried Calcium Sulphate,* $CaSO_4$, official 1890–1910.—Obtained from the purer varieties of gypsum, $CaSO_4 + 2H_2O$, by carefully heating at 105° C. (221° F.) until three-fourths of water expelled—$CaSO_4 + 2H_2O = CaSO_4$. It is a fine, white powder, odorless, tasteless, exposed to moist air absorbs water, becoming granular and losing the property of hardening with water; mixed with half-weight of water forms a smooth paste which hardens rapidly, soluble in water (378), readily in diluted nitric or hydrochloric acid, saturated solution of potassium nitrate, sodium thiosulphate, ammonium salts, insoluble in alcohol; contains 95 p. c. of pure salt, and 5

p. c. of water. Not used internally; chiefly by surgeons for mechanical purposes—casts, supports, etc., to immobilize injured or diseased parts, fractures; Pott's disease (spinal), lateral curvature, deformities of ankle- and knee-joints; fix bandages in amputation, dental surgery—oral impressions, molds for interdental splints, etc. Should be kept carefully protected from moisture, in well-closed containers.

3. *Calcis Carbonas. Carbonate of Lime.*—Formerly official under two forms, viz.: 1. *Calcis Carbonas Durus* (hard), Marmor, Marble, official 1830–1880; also called "native white granular carbonate of lime." 2. *Calcis Carbonas Mollis* (soft), Creta, Chalk, official 1830–1880; also called "native friable carbonate of lime."

4. *Calcii Lactophosphas. Calcium Lactophosphate.*—A mixture in variable proportions of calcium lactate, calcium acid lactate, calcium acid phosphate. It is in white granules, or white powder, odorless, soluble in water, almost insoluble in alcohol. Dose, gr. 5–15 (.3–1 Gm.).

BARIUM.

$Ba^{ii} = 137.37.$

The element barium (L. *bar(ytes)+ium*, fr. Gr. βαρύς, heavy, owing to high sp. gr. of heavy spar) and its compounds are not much used in medicine; it is found rarely in nature, and occurs then chiefly as sulphate (barite or heavy spar, $BaSO_4$), also as carbonate (witherite, $BaCO_3$). The metal fuses with difficulty, is of a silvery-gray color, decomposes water, oxidizes rapidly, sp. gr. 3.6. Salts are poisonous, but used sometimes in medicine as alterative, diuretic, cardiac tonic; cutaneous affections, scrofula; the sulphate employed to adulterate white lead, the nitrate in preparing green fire.

Tests for Barium Salts: 1. With H_2SO_4 or a soluble sulphate get white precipitate of barium sulphate, insoluble in all acids. 2. With alkaline carbonate get white precipitate, insoluble in excess. 3. With $K_2Cr_2O_7$ get pale yellow precipitate of $BaCrO_4$. 4. Gives yellowish-green color to flame.

Poisoning: Have salivation, thirst, vomiting, purging, abdominal pains, cramps, feeble pulse, dilated pupils, excessive urination, difficult breathing, spine paralysis, convulsions, collapse, death. Give emetics, magnesium or sodium sulphate (antidotes), albuminous drinks, diffusible stimulants, digitalis, opium, heat, etc.

Important Salts:

1. *Barii Sulphas. Barium Sulphate*, $BaSO_4$, official 1830–1840.—This is a native mineral (heavy spar) from which the other barium compounds are prepared. It is heavy, lamellar, brittle, sp. gr. 4.6, white or flesh-red. When heated decrepitates, melting into a white enamel (sulphide), which becomes a powder after some hours, insoluble in most solvents, therefore non-poisonous; soluble in excess of diluted hydrochloric acid. The artificial sulphate, made by precipitation from sulphide solution with diluted H_2SO_4, is known as *permanent white* or

blanc fix, used for glazing cards, in water colors, and by painters instead of white lead.

2. *Barii Carbonas. Barium Carbonate,* $BaCO_3$, official 1870–1880. —This is native *witherite,* found in lead mines in England, Scotland, Sweden. May be obtained artificially by precipitating a soluble barium salt with an alkali carbonate, or may fuse barium sulphate 10 parts, carbon 2, potassium hydroxide 5; wash the mass with water, thus leaving behind the carbonate—$BaSO_4 + C_2 + 2KOH = BaCO_3 + K_2S + CO_2 + H_2O$. It is in grayish fibrous masses or rhombic crystals, sp. gr. 4.5. If made artificially, it is a soft, white, amorphous or crystalline, tasteless powder. *Impurities:* Sulphate, lead, metals, alkalies, calcium. Other barium salts may readily be made by acting upon this salt with the respective acids; thus, nitrate—$BaCO_3 + 2HNO_3 = Ba(NO_3)_2 + H_2O + CO_2$, hydroxide—$BaCO_3 + 2KOH = Ba(OH)_2 + K_2CO_3$, also bromide, iodide, etc.

3. *Barii Chloridum. Barium Chloride,* $BaCl_2.2H_2O$, official 1870–1880.—Obtained by dissolving barium carbonate in diluted HCl, evaporating, crystallizing—$BaCO_3 + 2HCl = BaCl_2 + H_2O + CO_2$; or (1) $BaSO_4 + C_2 + \text{white heat} = BaS + 2CO_2$, (2) $BaS + 2HCl = BaCl_2 + H_2S$. While the first method, in which the native carbonate is used, is the better, that salt is so scarce that the second formula is followed generally. It is in colorless, translucent, rhomboidal tables or lamellæ, permanent, soluble in diluted alcohol or water. *Impurities:* Carbonate, sulphate, lead, metals, alkalies, calcium, strontium chloride. Used only in making Liquor Barii Chloridi (10 Gm. + water q. s. 100 Ml. (Cc.)).

4. *Barii Dioxidum. Barium Dioxide,* BaO_2, official 1890–1900.—Obtained by passing oxygen or air over barium oxide or hydroxide heated to redness. It is a heavy grayish or yellowish-white amorphous coarse powder, odorless, tasteless, nearly insoluble in water, forms salts with acids, slowly decomposes, absorbing H_2O and CO_2. Used only in making *Liquor Hydrogenii Dioxidi.*

The test-solutions of the carbonate, chloride, hydroxide, and nitrate are all used officially in assaying official salts, acids, etc.

STRONTIUM.

$Sr^{ii} = 87.6$.

The element strontium (L. fr. *strontian,* in Argyleshire, Scotland, where first found as *strontianite,* $SrCO_3$) in the form of its compounds was not until recently used to any extent in medicine. It occurs natively as sulphate (*celestite,* $SrSO_4$) and carbonate. The metal itself is yellow, malleable, harder than lead, sp. gr. 2.5, oxidizes quickly when exposed, hence has to be kept under naphtha, like the alkali metals. The salts can be produced in a manner similar to those of barium, thus: Heat strontium sulphate with carbon, which gives strontium sulphide; this sulphide dissolved in HCl yields the chloride, which by double decomposition with Na_2CO_3 gives pure strontium carbonate (strontii carbonas), $SrCO_3$, 99 p. c. purity, from which the official salts are made.

Tests for Strontium Salts: 1. With alkaline carbonates, oxalates, or phosphates get white precipitate. 2. With calcium sulphate get white precipitate of $SrSO_4$. 3. With H_2SO_4 or a soluble sulphate get white precipitate. 4. Add potassium chromate and get yellow precipitate, $SrCrO_4$, soluble in acids; here $K_2Cr_2O_7$ gives no precipitate. 5. Gives a beautiful red color to flame.

Strontii Bromidum. Strontium Bromide, $SrBr_2 + 6H_2O$.—(Syn., Stront. Brom.; Fr. Bromure de Strontium; Ger. Strontiumbromid.)

Manufacture: Dissolve strontium carbonate in hydrobromic acid until neutralized, evaporate, crystallize—$SrCO_3 + 2HBr = SrBr_2 + H_2O + CO_2$. It is in colorless, transparent, hexagonal crystals, odorless, bitter, saline taste, deliquescent (moist air), efflorescent (dry air), soluble in alcohol, water (.35), insoluble in ether; aqueous solution (1 in 20) neutral; contains 98 p. c. of pure salt. *Tests:* 1. Quickly heated—melts, and above 180° C. (356° F.) loses all water of crystallization; produces intensely crimson flame. 2. Aqueous solution (1 in 10) with silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid or moderate excess of ammonia water; aqueous solution (1 in 20) with calcium sulphate T. S.—slowly a white precipitate (strontium sulphate), insoluble in dilute acids; diluted sulphuric acid or readily soluble sulphate gives quicker precipitate. *Impurities:* Heavy metals, barium, iodine, bromate. Should be kept in well-closed containers. Dose, gr. 10–30 (.6–2 Gm.).

PROPERTIES AND USES.—Similar to potassium bromide—epilepsy, gastric disorders, albuminuria.

Strontii Iodidum. Strontium Iodide, $SrI_2 + 6H_2O$.—(Syn., Stront. Iod.; Fr. Iodure de Strontium; Ger. Strontiumjodid.)

Manufacture: Dissolve strontium carbonate in hydriodic acid until neutralized, evaporate, crystallize—$SrCO_3 + 2HI = SrI_2 + H_2O + CO_2$. It is in colorless, transparent, hexagonal plates, white, granular powder, crystalline crusts, odorless, bitter, saline taste, deliquescent and yellowish on exposure, soluble in water (.2), alcohol, slightly in ether; aqueous solution (1 in 20) neutral, slightly alkaline; contains 99 p. c. of pure salt. *Tests:* 1. Cautiously heated—crystals melt and gradually lose water of crystallization; at red heat—decomposed, losing iodine with residue of strontium oxide; produces intensely crimson flame. 2. Aqueous solution (1 in 10) with calcium sulphate T. S.—slowly a white precipitate (strontium sulphate), insoluble in dilute acids, diluted sulphuric acid or readily soluble sulphate gives quicker precipitate. 3. Aqueous solution (1 in 20) 5 Ml. (Cc.) with ferric chloride T. S. 1 Ml. (Cc.)—iodine liberated, which imparts violet color to chloroform, when shaken with it. *Impurities:* Heavy metals, barium, bromide, chloride, cyanide. Should be kept dark, in small, amber-colored, glass-stoppered bottles. Dose, gr. 10–30 (.6–2 Gm.).

Properties and Uses.—Alterative; does not irritate intestinal tract or depress nutrition; may be substituted for potassium iodide.

Strontii Salicylas. Strontium Salicylate, $Sr(C_7H_5O_3)_2 + 2H_2O$.—(Syn., Stront. Salicyl.; Fr. Salicylate de Strontium; Ger. Strontium salicylicum (salicylsaures.)

Manufacture: Dissolve salicylic acid (10) in hot water (100), add strontium carbonate (5.34), heat until effervescence ceases, filter, evaporate to crystallization. It is a white, crystalline powder, odorless, somewhat sweet, saline taste, soluble in water (19), boiling water (3.7), alcohol (61), boiling alcohol (14); contains, when dried to constant weight, 99 p. c. of pure salt. *Tests:* 1. When heated—decomposes with inflammable vapors of phenol odor, and residue of strontium carbonate and carbon; produces intensely red flame. 2. Aqueous solution (1 in 20) colorless, with calcium sulphate T. S.—slowly a white precipitate (strontium sulphate), insoluble in dilute acids. 3. Concentrated aqueous solution with a few drops of ferric chloride T. S.—dark red color and a precipitate; with diluted hydrochloric acid —voluminous, white precipitate (salicylic acid); aqueous solution (1 in 100)—deep violet-blue color. *Impurities:* Heavy metals, barium. Should be kept cool, dark, in well-closed containers. Dose, gr. 10–30 (.6–2 Gm.).

Properties and Uses.—Antirheumatic, tonic; rheumatism, gout, chorea, muscular pains, pleurisy, intestinal fermentation.

Incompatibles: Ferric salts, lime water, spirit nitrous ether, mineral acids, solutions of quinine salts, lead acetate, silver nitrate, sodium phosphate.

Allied Salts:

1. *Strontii Lactas. Strontium Lactate,* $Sr(C_3H_5O_3)_2 + 3H_2O$).—Obtained by dissolving strontium carbonate in lactic acid until neutralized, evaporate, crystallize—$SrCO_3 + 2HC_3H_5O_3 = Sr(C_3H_5O_3)_2 + H_2O + CO_2$. It is a white granular powder, or in crystalline nodules, odorless, bitter, saline taste, permanent; soluble in water (4), also in alcohol. By heat decomposes into carbonate, which effervesces with HCl. *Impurities:* Barium, carbonate, oxalate, chloride, butyrate, propionate, arsenic, lead, iron, aluminum. *Incompatibles:* Carbonate and sulphate solutions; potassium chromate. Diuretic; nephritis, albuminuria, rheumatism, gout, causes disappearance of the urates. Dose, gr. 10–30 (.6–2 Gm.), ter die.

Some of the unofficial salts, such as nitrate, etc., are used for red fire.

ALUMINUM.

$Al^{iii} = 27.1$.

The metal aluminum (L. *alumen, alumin(is)* + *um, alum,* fr. *alo,* to nourish, as confounded with iron sulphate) is the typical representative of the earths and the only one having any medicinal use, the other members being of only scientific interest. It occurs largely in combination with silicic acid in silicated rocks, clays, forming the greater bulk of our earth—basalt, feldspar, granite, hornblend, mica, slate—clay results from decomposition of these. The valuable minerals corundum, emery, ruby, and sapphire, are crystals of aluminum oxide colored with other substances. The metal is obtained by decomposing Al_2Cl_6 with metallic sodium—$Al_2Cl_6 + 6Na = 2Al + 6NaCl$. It is a very light, silvery-white metal, sp. gr. 2.6, capable of taking a high polish; owing to these properties the metal is used extensively.

Tests for Aluminum Salts.—1. Potassium or sodium hydroxide gives white gelatinous precipitate, soluble in excess. 2. Ammonium hydroxide gives a like precipitate, but insoluble in excess. 3. Alkaline carbonates precipitate also the white hydroxide with liberation of CO_2. 4. Ammonium sulphide precipitates hydroxide, liberating H_2S. 5. Sodium phosphate precipitates aluminum phosphate, soluble in acids.

Alumen. Alum, $AlNH_4(SO_4)_2 + 12H_2O$ or $AlK(SO_4)_2 + 12H_2O$.—(Syn., Aluminii et Ammonii Sulphas, Ammonium Alum; Fr. Alun ammoniacal; Ger. Ammoniak Alaun; Aluminii et Potassii Sulphas, Potassium Alum; Fr. Sulfate d'Alumine et de Potasse; Ger. Alaun, Kali-Alaun.)

Manufacture: Decompose aluminum silicate (alum-clay) with sulphuric acid, forming aluminum sulphate, and to this in solution add either ammonium sulphate or potassium sulphate, when, on evaporation, ammonium alum or potassium alum crystallizes. Both occur in large colorless crystals, crystalline fragments, white powder; odorless; sweetish, strongly astringent taste; ammonium alum is less soluble in water, and when strongly heated ammonium sulphate volatilizes; aqueous solution + potassium hydroxide T. S.—precipitate, soluble in excess, ammonia being evolved; incinerate—ash .5 p. c.; potassium alum is soluble in water (7.2), boiling water (.3), freely in glycerin, insoluble in alcohol; gives violet flame; saturated solution + sodium bitartrate T. S.—white crystalline precipitate; aqueous solution (1 in 20) + potassium hydroxide T. S.—precipitate, soluble in excess, but no ammonia evolved. *Tests:* 1. Aqueous solutions (1 in 20)—acid; fuses, and at 200° C. (392° F.) loses all water of crystallization. 2. Aqueous solution + ammonia water—white gelatinous precipitate, almost insoluble in excess. 3. With barium chloride T. S.—white precipitate, insoluble in hydrochloric acid; contains 99.5 p. c. of pure salt, and the label of container must indicate whether ammonium or potassium alum. *Impurities:* Heavy metals, iron, arsenic. Dose, gr. 5–30 (.3–2 Gm.), with sugar, syrup, etc.; emetic, ʒj–2 (4–8 Gm.).

PREPARATIONS.—1. *Alumen Exsiccatum.* Exsiccated Alum, $AlNH_4(SO_4)_2$ or $AlK(SO_4)_2$.—(Syn., Alum, Exsic., Alumen Ustum, Dried Alum, Burnt Alum; Fr. Alun calciné—desséché—brulé; Ger. Alumen ustum, Gebrannter Alaun.)

Manufacture: Heat alum (in thin layer) 100 Gm. on sand-bath until it liquefies, then continue heat, with constant stirring, until porous mass weighs 55 Gm.; cool, powder. It is a white, granular powder; odorless; sweetish, astringent taste, attracting moisture on exposure, soluble in water (20), boiling water (1.5), insoluble in alcohol; dried in air-bath—loss 10 p. c.; contains 96.5 p. c. of pure anhydrous salt, and the label of the container should indicate whether from ammonium or potassium alum. *Tests* and *Impurities*: same as for alumen. Should be kept in well-closed containers and not dispensed if containing more than 10 p. c. of moisture.

2. *Alumini Hydroxidum.* Aluminum Hydroxide, $Al(OH)_3$.—(Syn., Alum. Hydrox., Alumini Hydras, Hydrated Alumina; Fr. Hydrate d'Alumine; Ger. Thonerdehydrat, Argilla (Pura) Hydrata.)

Manufacture: Dissolve alum 10 Gm., monohydrated sodium carbonate 4.5 Gm., each separately in water 100 Ml. (Cc.), filter, heat to boiling, add alum solution to sodium, stirring constantly, wash precipitate with hot water, drain, dry, powder—$3Na_2CO_3 + 2AlNH_4(SO_4)_2 + 3H_2O = 3Na_2SO_4 + (NH_4)_2SO_4 + 2Al(OH)_3 + 3CO_2$. It is a white, bulky, amorphous powder, odorless, tasteless, permanent, insoluble in water, alcohol, soluble in hydrochloric or sulphuric acid, fixed alkali hydroxides. *Tests:* 1. Solution in hydrochloric or sulphuric acid + potassium hydroxide T. S.—white gelatinous precipitate, soluble in excess and reprecipitated by excess of ammonium chloride. 2. Heated to redness—loses 34 p. c. of weight; consists principally of pure salt. *Impurities:* Heavy metals, arsenic, alkali salts. Dose, gr. 3–6 (.2–.4 Gm.).

Unoff. Preps.: Liquor Alumini Acetico-Tartratis—ammonium alum 75 p. c., + monohydrated sodium carbonate 30; dissolve each in water 1000, mix, dissolve magma in glacial acetic acid 15 + tartaric acid 13.5 with heat, evaporate to 100. *Glycerinum Aluminis* (Br.), 15 p. c.

PROPERTIES AND USES.—Astringent, irritant, emetic, purgative; hemorrhage, serous diarrhœa, colliquative sweats, menorrhagia, hæmaturia, gastric intestinal catarrh, dysentery, diabetes, bronchitis, whooping-cough, lead colic, croup, narcotic poisoning, intermittent fever, ophthalmia, ecchymoses, sore throat, aphonia, ingrowing toe-nails, chilblains, ulcers, burns, relaxed gums, uvula, pharynx, vagina, anus, gonorrhœa, gleet, leucorrhœa, toothache. Dried Alum—astringent, stimulant, escharotic, more powerful than the preceding; fungous granulations, ulcers, insufflation. Both are applied locally in powder, lotion, injection, sprays, gargles (3–5 p. c.). Aluminum Hydroxide—resembles medicinally bismuth oxide and magnesium oxide; feebly astringent, desiccant powder, antacid; used externally on skin in inflammations, dyspepsia, diarrhœa, intertrigo, superficial burns.

Incompatibles: Alkalies, lime, lead, mercury, iron salts, tartrates, tannin.

Allied Salts:

1. *Alumini Sulphas. Aluminum Sulphate,* $Al_2(SO_4)_3 + 16H_2O$, official 1860–1910.—Obtained by dissolving freshly precipitated aluminum

hydroxide in diluted sulphuric acid, crystallizing or evaporating to dryness. It is a white crystalline powder, shining plates or crystalline fragments, odorless, sweetish, astringent taste, permanent, soluble in water (1), insoluble in alcohol, heated to 200° C. (392° F.) loses water of crystallization (45.7 p. c.); contains 99.5 p. c. of pure salt. Disinfectant, deodorant, antiseptic; leucorrhœa, chronic dysentery, ulcers, cancer, nævi, polypi, fetid discharges, enlarged tonsils, nasal catarrh, diseases of os uteri, scrofulous sores; injection (50 p. c.) is of value in preserving subjects for dissection, but less so than zinc chloride. Not used internally. Liquor Alumini Acetatis, 8.5 Gm., lead acetate 15 Gm.; dissolve each in water 50, mix, wash magma. Liquor Alumini Subacetatis, 30 Gm.; dissolve in water 90, add precipitated calcium carbonate 13.8, acetic acid 30, both in portions, after several days wash magma.

2. *Alumini Chloridum, Aluminum Chloride,* $AlCl_3 + 6H_2O$.—Obtained by passing chlorine over a mixture of Al_2O_3 and carbon at red heat. It is a white, yellowish-white, deliquescent crystalline powder, nearly odorless, sweetish, astringent taste, soluble in water (.5), alcohol (5), glycerin; contains salt corresponding to 20.5 p. c. of Al_2O_3. Dose, gr. 5–10 (.3–.6 Gm.). Disinfectant; solution of 1 part dissolved in water and mixed with alum 2 parts dissolved in water (filtering from precipitate of calcium sulphate) is valuable. Aluminum Gallate and Aluminum Tannate—good astringents in ozæna.

3. *Kaolinum, Kaolin, Fuller's Earth,* $H_2Al_2Si_2O_3 + H_2O$, official 1900–1910.—This native aluminum silicate, consisting chiefly of pure silicate, powdered and freed from gritty particles by elutriation, is found in large deposits in the earth, being the product of the weathering action of carbon dioxide and water on feldspar minerals (potassium aluminum silicate, $KAlSi_3O_8$), in which the potassium silicate formed is removed by rain-water, absorbed by the soil, and in turn by plants, leaving behind insoluble kaolin. It is a soft, whitish powder, lumps, earthy or clay-like taste, insoluble in water, diluted acids, alkali hydroxides. Cataplasm of Kaolin (*Cataplasma Kaolini,* U. S. P. 1900), made by heating for 1 hour at 100° C. (212° F.) powdered kaolin 577 Gm., occasionally stirring, mixing with boric acid 45 Gm., glycerin 375 Gm., thymol .5 Gm. dissolved in methyl salicylate 2 Gm., oil of peppermint .5 Gm.—rubbing to a homogeneous mass; resembles soft putty. Drying agent, emollient; to clarify, decolorize vegetable and animal oils (wine, beer, honey, syrups), dusting powder on irritated surfaces, sores, excipient for silver nitrate, potassium permanganate, etc.; Cataplasm—counter-irritant, exosmotic, antiseptic, due to the hygroscopic power of glycerin; induces superficial hyperæmia, relieving deep-seated congestion, pain (pneumonia, pleurisy, bronchitis, peritonitis, sprains, boils, periostitis, mastitis, orchitis, etc.), replacing flaxseed and mustard poultices, liniments, antiphlogistine, etc., and should be applied freely and as hot as can be borne, being heated by placing container in boiling water; impaired by exposure.

CERIUM.

$Ce^{iv} = 140.25$.

The element cerium (named by Berzelius, 1803, after asteriod *Ceres*, then just discovered, 1801) occurs sparingly in nature, chiefly in cerite, also in gadolinite, allanite, and orthite. Monzanite sand, N. Ca., contains cerite, also silicates or oxides or phosphates of other earthy metals, as zirconium, erbium, thorium. The oxide of thorium gives a bright white light at comparatively low temperature, on which account it is employed in the mantle of the *Welsbach* incandescent burner. Cerium resembles aluminum in chemical behavior, but its salts act medicinally like those of bismuth and silver. The metal itself is chocolate-brown, burning more easily than magnesium, oxidizing readily in moist atmosphere, and forms two oxides—*cerous*, Ce_2O_3, and *ceric*, CeO_2. We have only one official salt.

Tests for Cerium Salts: 1. If to a colorless cerous salt sodium hypochlorite be added, we get a red precipitate, which is soluble in warm HCl with evolution of chlorine. 2. Any residue, after heating a cerium salt, dissolved in H_2SO_4 and strychnine crystal added, gives a deep blue, changing to purple, then red.

Cerii Oxalas. Cerium Oxalate, $Ce_2(C_2O_4)_3.9H_2O$ +.—(Syn., Cerii Oxal., Cerous Oxalate, Oxalas Cericus; Fr. Oxalate de Cerium; Ger. Cerium Oxalicum, Oxalsaures Ceroxydul, Ceroxalat.)

Manufacture: This salt consists chiefly of a mixture of the oxalates of cereum, didymium, lanthanum, and other associated elements, and is obtained by digesting cerite (native silicate) with sulphuric acid, dissolving dried mass in diluted nitric acid and passing into the solution hydrogen sulphide, to remove copper and other metals; to filtered solution add hydrochloric acid, to retain calcium salt, and oxalic acid to precipitate the cerite metals as oxalates, mix with magnesium carbonate, calcine to decompose oxalates, dissolve residue in nitric acid, and pour into water (large quantity) containing .5 p. c. of sulphuric acid to precipitate yellow ceric sulphate, lanthanum, didymium, and magnesium remaining in solution, dissolve ceric sulphate in sulphuric acid, reduce to cerous sulphate by sodium thiosulphate, and precipitate cerous oxalate with oxalic acid, dry. It is a fine white, slightly pink, powder, odorless, tasteless, permanent, insoluble in water, alcohol, ether, solutions of potassium or sodium hydroxide, insoluble in cold but soluble in hot diluted sulphuric or hydrochloric acid; heated to redness decomposes leaving 47 p. c. of the salt—reddish brown residue. *Tests:* 1. Boil with potassium hydroxide T. S.—insoluble precipitate (white hydroxides); supersaturate filtrate with acetic acid, + calcium chloride T. S.—white precipitate, insoluble in acetic acid, but soluble in hydrochloric acid. 2. Dissolve in diluted hydrochloric or sulphuric acid, + potassium hydroxide T. S.—precipitate (white hydroxides) insoluble in large excess of reagent but yellowish on exposure, + ammonium carbonate T. S.—white precipitate (cerium carbonate, +) somewhat soluble in large excess of reagent. *Impurities:* Heavy metals, arsenic, aluminum, zinc, carbonates. Dose, gr. 1–10 (.06–.6 Gm.), ter die, in powder, pill, water.

Properties and Uses.—Nervous and gastric sedative, similar to bismuth subnitrate; nausea, vomiting of pregnancy, sea-sickness, asthma, uterine disorders, hysteria, dyspepsia, pyrosis, cough of phthisis, bronchitis, chorea.

FERRUM. IRON.

$Fe^{ii} = 55.84$. $Fe_2^{vi} = 111.68$.

The element iron (AS, *iren*, Goth. *iarn*, metal; L. *ferrum*) is the most useful and abundant of the heavier metals, being present in nearly all rocks, soils, animal and plant ashes, but seldom in the pure state. It occurs as sulphide—iron pyrites, FeS_2; as oxide—magnetic iron ore, FeO,Fe_2O_3; red hematite, Fe_2O_3; as carbonate—spathic iron ore, $FeCO_3$, and also combined with mineral acids. From any of these ores the metal may be obtained by reducing with carbon, which consists in heating in a blast furnace iron ore, coke, or coal, and some flux, as limestone or clay. This latter forms a more fusible aluminum and calcium silicate or slag. (1) $Fe_2O_3 + 3C = 2Fe + 3CO$. (2) $FeCO_3 + C = Fe + CO_2 + CO$. (3) $FeS_2 + O_4 = Fe + 2SO_2$. As such it is known as cast or pig iron, and is not pure by reason of its containing traces of silicon, sulphur, phosphorus, and carbon, 2–5 p. c. By puddling or refining, the carbon combines with a blast of oxygen and is blown out, leaving wrought or bar iron, having still present carbon .03–.3 p. c. Steel is a product intermediate between these two, containing carbon .5–2 p. c. Iron is hard, malleable, ductile, tenacious, grayish, fibrous texture; taste slightly styptic, odor slight, magnetic, sp. gr. 7.7, least fusible of all useful metals excepting platinum, readily oxidizes in moisture and forms two kinds of salts, *ferrous* (lower) and *ferric* (higher). The metal itself and many important salts are official.

Tests for Iron Salts: 1. Ferrous salt with potassium ferrocyanide gives a nearly white precipitate, turning blue on exposure to air; with ferric salt have deep blue color at once—Prussian blue. 2. Ferrous salt with potassium ferricyanide gives at once deep blue color—Turnbull's blue; with ferric salts have greenish-olive color. 3. Ferrous salt with tannin has no effect; with ferric salt have greenish-black precipitate—ferric tannate (ink). 4. Ammonium sulphide gives black precipitate with both kinds of salts. 5. Ferrous salts with ammonia water give whitish precipitate, turning green, then black, finally brown; with ferric salts have precipitate of brown ferric hydroxide.

Ferrum. Iron.—(Syn., Ferr., Iron wire, Mars; Fr. Fer (metallique), Fil de Fer; Ger. Eisen, Eisendraht.) Metallic iron in the form of fine, bright, and non-elastic wire; the grease or paraffin oil used in coating for protection against moisture and oxidation (rust) should be removed previous to use. Wire in form of card teeth wastings is most convenient purest, and cheapest.

Preparations.—(Unoff.): *Liquor Ferri Protochloride*, 16 p. c., + hydrochloric acid 62.5, glycerin 25, dil. hypophosphorous acid 1, dist. water q. s. 100. *Syrupus Ferri et Mangani Iodidi*—iodine 8.15 Gm., iron wire 2.8, manganese sulphate 2.65, sodium iodide 3.56, +. *Syrupus Ferri Phosphatis* (Br.), each ʒj (4 Ml. (Cc.)) contains 1 gr. (.06 Gm.) ferrous phosphate, dose, ʒss–1 (2–4 Ml. (Cc.)). *Vinum Ferri* (Br.), 5 p. c. + sherry wine, dose, ʒj–4 (4–15 Ml. (Cc.)).

Ferrum Reductum. Reduced Iron.—(Syn., Ferr. Reduct., Ferrum Redactum, Iron (reduced) by Hydrogen, Quevenne's Iron, Powder of Iron, Ferrum Hydrogenio Reductum, Ferrum Ope Hydrogenii Paratum; Fr. Fer réduit par l'Hydrogène; Ger. Reduziertes Eisen.)

Manufacture: Freshly prepared ferric hydroxide (or subcarbonate), thoroughly washed and dried, is put into the central portion of a glass tube, the ends being filled with asbestos and corked, each cork being perforated by a smaller glass tube; the tube is put into a furnace and brought to red heat. Through this tube now is passed pure dry hydrogen, made from zinc and H_2SO_4, which is continued until furnace and tube have cooled—$Fe_2O_3 + 6H + \text{heat} = 2\,Fe + 3H_2O$. It is a very fine, grayish-black, lustreless powder, odorless, tasteless, permanent, insoluble in water, alcohol, heated in air ignites and glows, being converted into black ferroso-ferric oxide; contains 90 p. c. of metallic iron, Fe. *Tests:* 1. Shake with distilled water (5)—liquid does not change color of litmus. *Impurities:* Arsenic, sulphide, etc. Should be kept in well-closed containers. Dose, gr. 1–5 (.06–.3 Gm.), at mealtime, in pill, wafer.

Preparations.—(Unoff.): *Trochiscus Ferri Redacti* (Br.), each 1 gr. (.06 Gm.). *Extractum Ferri Pomatum*, 4 p. c., + fresh apple juice 100, heat, evaporate to pilular consistence, dose, gr. 5–15 (.3–1 Gm.). *Pilulæ Ferri, Quininæ, Strychninæ et Arseni Mites*—reduced iron 4.5 Gm., quinine sulphate 6.5, strychnine .13, arsenic trioxide .13, clarified honey q. s. 100 pills. *Pilulæ Ferri, Quininæ, Strychninæ et Arseni Fortiores:* reduced iron 6.5 Gm., quinine sulphate 6.5, strychnine .32, arsenic trioxide .32, clarified honey q. s. 100 pills. *Tinctura Ferri Pomata*—ferrated extract of apples 10, alcohol 10, cinnamon water q. s. 100.

Properties and Uses.—Originally this was prepared as a substitute for the ferri subcarbonas, by Quevenne, of Paris. It is a chalybeate tonic, but very prone to derange the stomach, owing to formation of H_2S from the impurities.

Liquor Ferri Chloridi. Solution of Ferric Chloride.—(Syn., Liq. Ferr. Chlor., Solution of Iron Perchloride, Liquor Ferri Muriatici Oxydati, Ferrum Sesquichloratum Solutium; Br. Liquor Ferri Perchloridi Fortis; Fr. Soluté de Perchlorure de Fer, Chlorure ferrique liquide; Ger. Liquor Ferri sesquichlorati (Flüssiges), Eisenchloridlösung.)

Manufacture: To a flask containing iron wire 12.5 Gm. add hydrochloric acid 42 Gm. diluted with distilled water 25 Ml. (Cc.), heat on water-bath until effervescence ceases ($1\frac{1}{4}$ hours), boil, filter, rinse flask and iron wire with little hot distilled water; to filtered liquid, including rinsings, add hydrochloric acid 22 Gm. and this mixture in a slow stream to nitric acid 6.5 Gm., warm gently; after effervescence ceases, heat until free from nitric acid; if solution black add nitric acid in drops until red fumes no longer escape, finally add hydrochloric acid 4 Gm., and distilled water q. s. 100 Gm. It is a reddish-brown aqueous liquid, faint odor of hydrochloric acid; an acid, strongly styptic taste, acid reaction, sp. gr. 1.30; contains ferric chloride, $FeCl_3$, corresponding to 10–11 p. c. of iron. *Tests:* 1. Aqueous solution (1 in 10); with ammonia water—brownish-red precipitate; with potassium ferrocyanide T. S.—blue precipitate; with silver nitrate T. S.—white precipitate, insoluble in nitric acid. *Impurities:* Zinc, copper, lead, salts of fixed alkalies, ferrous salts, free hydrochloric acid, nitric acid. Should be kept dark, in glass-stoppered bottles. Dose, ♏ij–10 (.13–.6 Ml. (Cc.)), well diluted with water or syrup.

PREPARATIONS.—1. *Ferri Chloridum.* Ferric Chloride, $FeCl_3(Fe_2Cl_6.12H_2O)$. (Syn., Ferr. Chlor., Iron Perchloride, Sesquichloride of Iron, Ferrum Muriaticum Oxydatum, Ferri Perchloridum; Fr. Perchlorure de Fer, Chlorure ferrique; Ger. Ferrum sesquichloratum, Eisenchlorid.)

Manufacture: Evaporate on water-bath solution of ferric chloride 100 Gm. until it weighs 40 Gm., set aside to crystallize, break into pieces. It is in orange-yellow crystalline pieces, odorless or faint odor of hydrochloric acid, strongly styptic taste, very deliquescent, soluble in water (.2), alcohol, glycerin, ether, fuses at 35.5° C. (96° F.) to a reddish-brown liquid, strongly heated decomposes, leaving residue of ferric oxide; contains ferric chloride, $FeCl_3$, in hydrated form corresponding to 20 p. c. of iron. *Impurities:* Heavy metals, ferrous salt, nitric acid. Dose, gr. 1–5 (.06–.3 Gm.).

2. *Tinctura Ferri Chloridi.* Tincture of Ferric Chloride. (Syn., Tr. Ferr. Chlor., Tinctura Ferri (Muriatis) Sesquichloridi; Br. Tinctura Ferri Perchloridi; Fr. Teinture de Perchlorure de Fer; Ger. Eisenchloridtinktur.)

Manufacture: Mix solution of ferric chloride 35 Ml. (Cc.) with alcohol q. s. 100 Ml. (Cc.). It is a bright, amber-colored, hydroalcoholic liquid (solution), slight ethereal odor, very astringent, styptic taste, acid reaction, sp. gr. 1.000; contains ferric chloride, $FeCl_3$, about 13 p. c., corresponding to 4.48 p. c. of iron. *Tests:* 1. With ammonia water—brownish-red precipitate; with potassium ferrocyanide T. S.—blue precipitate; with silver nitrate T. S.—white precipitate, insoluble in nitric acid. *Impurities:* Ferrous salt (due to reduction), nitric acid. Should be kept dark, in amber-colored, glass-stoppered bottles, and not dispensed for at least 3 months. Dose, ♏x–30 (.6–2 Ml. (Cc.)).

Prep.: 1. *Liquor Ferri et Ammonii Acetatis.* Solution of Iron and Ammonium Acetate. (Syn., Liq. Ferr. et Ammon. Acet., Basham's Mixture, Mistura Ferri et Ammonii Acetatis.)

Manufacture: To solution of ammonium acetate 50 Ml. (Cc.), which must be slightly acid, add, successively, diluted acetic acid 6 Ml. (Cc.), tincture of ferric chloride 4, aromatic elixir 12, glycerin 12, water q. s. 100 Ml. (Cc.). It is a clear, reddish-brown liquid, sweetish, saline, afterward slightly astringent taste, aromatic odor, acid reaction, sp. gr. 1.039. *Tests:* 1. With potassium ferrocyanide T. S.—blue precipitate, but the addition of ammonia water—no precipitate. 2. Heat with potassium hydroxide T. S.—ammonia evolved. 3. To 5 Ml. (Cc.) add sulphuric acid and alcohol, each 1 Ml. (Cc.)—ethyl acetate formed, recognized by odor; must not be dispensed unless recently prepared, as it deteriorates by age. Dose, ʒj–4 (4–15 Ml. (Cc.), diluted.

Unoff. Preps.: Liquor Ferri Oxychloridi—30 Ml. (Cc.), precipitate with ammonia water 60 (both diluted), wash magma, add hydrochloric acid 3, glycerin 12.5, water q. s. 100. *Liquor Ferri Albuminati*—add to fresh egg albumen 6 Gm. (diluted) solution of ferric oxychloride 13, sodium citrate (dissolved) 1.25, aromatic elixir 40, alcohol 12, dist. water q. s. 100. *Liquor Ferri Perchloridi* (Br.)—25 Ml. (Cc.), water q. s. 100, dose, ♏x–30 (.6–2 Ml. (Cc.)). *Liquor Ferri Peptonati*—solution of ferric oxychloride 12 p. c., fresh egg albumen 9, pepsin .1, hydrochloric acid .4, sodium citrate 2, +. *Liquor Ferri Peptonati et Mangani*—solution of ferric oxychloride 12 p. c., fresh egg albumen 9, pepsin .1, hydrochloric acid .4, soluble manganese citrate 1, sodium citrate 3.5, +. *Tinctura Ferri Chloridi Ætherea,* 6 Ml. (Cc.), ether 25, alcohol q. s. 100, decolorize in the sun. *Tinctura Ferri Citro-Chloridi,* 35 Ml. (Cc.), sodium citrate 50, alcohol 15, water q. s. 100. *Liquor Ferri Salicylatis*—tincture of ferric citro-chloride 12.5 Ml. (Cc.), sodium salicylate 12.5, ammonium carbonate .65, citric acid .85, glycerin 17.5, +. *Syrupus Ferri Protochloridi,* 5 p. c.

Properties and Uses.—Liquor Ferri Chloridi—styptic, when injected into vessels coagulates blood; used to cure varices, hemorrhages, incontinence of urine, vesical catarrh, leucorrhœa, injection for aneurism, nasal polypi, erectile tumors; externally in varicose veins, hemorrhoids, vascular growths, ulcers, cancers, diphtheria, ophthalmia, chilblains, ingrown nails, ulcerated gums, gangrene, hydrocele, prolapsed rectum, sweating of the feet. Ferri Chloridum—powerful astringent, hæmostatic; chiefly used locally for stanching hemorrhage, as in epistaxis, hæmoptysis—by inhaling an atomized solution, leech-bites, on gums after teeth extracted, uterine ulcers, lupoid skin diseases. Tinctura Ferri Chloridi—tonic in scrofula, diuretic; gonorrhœa, gleet, leucorrhœa, dysury, hemorrhages from uterus, kidneys, bladder, erysipelas, scarlatina, diphtheria, purulent infection of the blood, venereal warts, cancerous, fungous ulcers, injection in aneurisms, sweats, puerperal fever, chilblains, poisoning by rhus toxicodendron, acute articular rheumatism. Liquor Ferri et Am. Acetatis—albuminuria, chronic Bright's disease. The astringency of these preparations can be neutralized with sodium bicarbonate or citrate. They as well as all other acid preparations should be taken through a glass tube, to prevent the liquids coming into contact with the teeth. If this be impossible at times, the mouth should then be rinsed well with water in which an alkali has been dissolved.

Syrupus Ferri Iodidi. Syrup of Ferrous Iodide.—(Syn., Syr. Ferr. Iod.; Fr. Sirop d'Iodure de Fer; Ger. Sirupus Ferri jodati, Jodeisensirup.)

Manufacture: Mix, in a flask, iron (fine, bright wire—card teeth) 1.25 Gm., iodine 4.15 Gm., distilled water 15 Ml. (Cc.), shake occasionally, checking reaction, if necessary, by placing flask in cold water, and when solution greenish and lost iodine odor, heat to boiling, add sugar 5 Gm., and when dissolved filter into sugar 52.5 Gm., rinse flask and iron wire with distilled water 12.5 Ml. (Cc.), filter into the sugar, stir with glass rod, heat on water-bath until solution effected, strain into a tared bottle, add diluted hypophosphorous acid 2 Ml. (Cc.), and distilled water q. s. 100 Gm. It is a transparent, pale yellowish-green, syrupy liquid, sweet, strongly ferruginous taste, slightly acid reaction, sp. gr. 1.350; contains 4.75–5.25 p. c. of ferrous iodide, FeI_2. *Test:* 1. Mix 5 Ml. (Cc.) with a few drops of potassium ferricyanide T. S.—blue precipitate. *Impurities:* Free iodine, etc. Should be kept in completely filled, tightly-stoppered bottles. Dose, ♏x–40 (.6–2.6 Ml. (Cc.)), in water. after meals.

Pilulæ Ferri Iodidi. Pills of Ferrous Iodide.—(Syn., Pil. Ferr. Iod.; Fr. Pilules d'Iodure de Fer (ferreuse), Pilules de Blancard; Ger. Eisenjodürpillen.)

Manufacture: Add, in a mortar, 6 Ml. (Cc.) of water to reduced iron 4 Gm., gradually add iodine 5 Gm., constantly stirring, until reddish tint disappears, then add, previously well triturated together, glycyrrhiza 4 Gm., sugar 4 Gm., extract of glycyrrhiza 1 Gm., acacia 1 Gm., mix thoroughly, evaporate, constantly stirring, to pilular consistence, make into 100 pills; dissolve balsam of tolu 10 Gm. in ether 15 Ml. (Cc.), and in sufficient quantity of this shake pills until coated, put on a plate, roll occasionally until dry. Should be kept in well-stoppered bottles. Dose, 1–2 pills.

PROPERTIES AND USES.—All of the iodide of iron preparations are tonic, alterative, diuretic, emmenagogue; scrofula, anæmia from scrofula; tuberculosis, secondary syphilis, skin affections, chronic rheumatism, amenorrhœa, leucorrhœa, swollen glands, etc.

Ferri Sulphas. Ferrous Sulphate, $FeSO_4 + 7H_2O$. (Syn., Ferr. Sulph., Iron Protosulphate, Green Vitriol, Copperas, Sulfas Ferrosus, Ferrum Vitriolatum Purum, Vitriolum Martis Purum; Fr. Sulfate de Fer (ferreux); Ger. Ferrum sulfuricum, Ferrosulfat, Schwefelsaures Eisenoxydul.)

Manufacture: Dissolve iron wire in diluted sulphuric acid by aid of heat, evaporate, crystallize—$Fe_2 + 2H_2SO_4 = 2FeSO_4 + H_4$. It is in pale bluish-green, monoclinic prisms, odorless, saline styptic taste; efflorescent in dry air, rapidly oxidizes in moist air, becoming coated with brownish-yellow, basic ferric sulphate, when it should not be used officially; soluble in water (1.4), boiling water (.4), insoluble in alcohol; aqueous solution acid, crystals disintegrate at 115° C. (239° F.), losing most of its water of crystallization; contains 54.36–57.07 p. c. of anhydrous ferrous sulphate, corresponding to 99.5 p. c. of crystallized salt. *Tests:* 1. Aqueous solution with potassium ferricyanide T. S.—blue color or precipitate; with barium chloride T. S.—white precipitate insoluble in hydrochloric acid. *Impurities:* Heavy metals, free acid. Should be kept in well-closed containers. Dose, gr. 1–5 (.06–.3 Gm.).

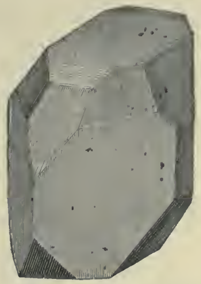


FIG. 459. — Ferrous sulphate crystal.

PREPARATIONS.—1. *Ferri Sulphas Exsiccatus.* Exsiccated Ferrous Sulphate, $2FeSO_4 + 3H_2O$. (Syn., Ferr. Sulph. Exsic., Dried Ferrous Sulphate; Fr. Sulfate (ferreux) de Fer desséché; Ger. Ferrum sulfuricum siccum, Getrocknetes Ferrosulfat, Entwässertes (Schwefelsaures Eisenoxydul) Ferrosulfat.)

Manufacture: Allow ferrous sulphate 100 Gm. to effloresce in dry air at 40° C. (104° F.), heat on water-bath, constantly stirring, until it weighs 64–65 Gm., pulverize. It is a grayish-white powder, slowly soluble in water; aqueous solution boiled and cooled—only slightly turbid; contains 80 p. c. of anhydrous salt. Should be kept in dry, well-stoppered bottles. Dose, gr. ½–3 (.03–.2 Gm.).

2. *Ferri Sulphas Granulatus.* Granulated Ferrous Sulphate, $FeSO_4 + 7H_2O$.—(Syn., Ferr. Sulph. Gran., Precipitated Ferrous Sulphate; Fr. Sulfate ferreux précipité; Ger. Præcipitirtes Ferrosulfat.)

Manufacture: Dissolve ferrous sulphate 100 Gm. in boiling distilled water 100 Ml. (Cc.), add diluted sulphuric acid 5 Ml. (Cc.), filter, evaporate to 150 Gm., cool quickly with constant stirring, when it crystallizes, drain crystals, pour upon them alcohol 25 Ml. (Cc.), drain, spread on bibulous paper, dry quickly; the acid prevents oxidation of the ferrous sulphate, the alcohol removes acid and uncombined water, hence facilitates drying. It is a very pale bluish-green, crystalline powder, responding to tests for ferri sulphas. Should be kept dry, in well-stoppered bottles. Dose, gr. 1–5 (.06–.3 Gm.).

Prep.: 1. *Pilulæ Ferri Carbonatis,* 2½ gr. (.16 Gm.).

Unoff. Preps.: Mistura Ferri Composita. Griffith's Mixture, official 1830–1910; rub until uniform myrrh 1.8 Gm., sugar 1.8 Gm., potassium carbonate .8 Gm., with rose water 70 Ml. (Cc.), add spirit of lavender 6 Ml. (Cc.), then ferrous sulphate, crystals, .6 Gm. previously dissolved in rose water 5 Ml. (Cc.), finally rose water q. s. 100 Ml. (Cc.); dark green, and always should be fresh, dose, ℥j–2 (30–60 Ml. (Cc.)). *Liquor Ferri Oxysulphatis*, 16.5 Gm., nitric acid 16.5, heat, cool, add dist. water q. s. 100.

Properties and Uses.—Astringent, chalybeate, disinfectant. Overdoses cause nausea, vomiting, griping, purging, gastric inflammation; often not dissolved, thus causing impaction, which is best relieved by saline cathartics; hemorrhages, colliquative sweats, leucorrhœa, gleet, chronic diarrhœa, gastric catarrh, ulcers. With aloes relieves constipation. Externally—in ophthalmia, erysipelas. Ointment (dried sulphate 1 + lard 20) useful in skin diseases (eczema, intertrigo, impetigo), syphilitic and scrofulous sores.

Liquor Ferri Subsulphatis. Solution of Ferric Subsulphate.—(Syn., Liq. Ferr. Subsulph., Monsel's Solution, Solution of Basic Ferric Sulphate, Solution of Persulphate (improperly) of Iron; Fr. Liqueur hémostatique de Monsel; Ger. Basisch-Schwefelsaure Eisenoxydlösung, Monselsche Eisenlösung.)

Manufacture: Add sulphuric acid 6.5 Gm. to distilled water 50 Ml. (Cc.), heat to nearly 100° C. (212° F.), add nitric acid 7 Gm., mix well; divide ferrous sulphate 67.5 Gm., coarsely powdered, into four equal portions, add one at a time to the hot liquid, stirring after each until effervescence ceases; if, after ferrous sulphate is dissolved, solution be black, add nitric acid by drops, heating and stirring, until red fumes cease to be evolved; boil until solution red and free from nitric acid, add distilled water, a little occasionally, and finally q. s. 100 Gm., filter. It is a dark reddish-brown aqueous liquid, odorless or nearly so, acid, strongly styptic taste, acid reaction, miscible with water and alcohol without decomposition, sp. gr. 1.548; contains basic ferric sulphate ($Fe_4O(SO_4)_5$?) corresponding to 13–14 p. c. of iron. *Tests:* 1. Aqueous dilution (1 in 20) with: (*a*) ammonia water—brownish-red precipitate; (*b*) potassium ferrocyanide T. S.—blue precipitate; (*c*) barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. *Impurities:* Nitric acid, ferrous salt. When solution crystallizes into a semi-solid whitish mass gently heating restores the liquid condition. Should be kept dark, moderately warm, in well-stoppered containers. Dose, ♏iij–10 (.2–.6 Ml. (Cc.)), well diluted. When physicians order solution of persulphate of iron, this preparation should be dispensed.

Properties and Uses.—Owing to its deficiency in H_2SO_4, this solution when evaporated yields a salt less irritating than the liquor tersulphatis, and one having greater astringency. It was introduced in 1857 by M. Monsel to coagulate blood, hence of use in hemorrhages from cuts, wounds, where irritation is to be avoided, chancre, hæmoptysis, diarrhœa, hemorrhages from stomach, bowels, etc.

Liquor Ferri Tersulphatis. Solution of Ferric Sulphate.—(Syn., Liq. Ferr. Tersulph., Solution of Iron Tersulphate, Solution of Normal Ferric Sulphate; Br. Liquor Ferri Persulphatis; Fr. Persulfate de Fer liquide; Ger. Flüssiges Schwefelsaures Eisenoxyd, Liquor Ferri Sulfurici Oxydati.)

Manufacture: Add sulphuric acid 9.6 Gm. to distilled water 25 Ml. (Cc.), heat to nearly 100° C. (212° F.), add nitric acid 5.6 Gm., mix well; divide ferrous sulphate 50 Gm., coarsely powdered, into four equal portions, add one at a time to the hot liquid, stirring after each until effervescence ceases; if, after ferrous sulphate is dissolved, solution be black, add nitric acid by drops, heating and stirring, until red fumes cease to be evolved; boil until solution reddish-brown and free from nitric acid; add distilled water, a little occasionally, and finally q. s. 100 Gm., filter—$6\ (FeSO_4 + 7H_2O) + 3H_2SO_4 + 2HNO_3 = 3Fe_2(SO_4)_3 + 2NO + 46H_2O$, thus showing formation of normal salt, which is not true in the preceding liquor. It is a yellowish-brown aqueous liquid, almost odorless, acid, strongly styptic taste, acid reaction, miscible with water and alcohol in all proportions, sp. gr. 1.432; contains normal ferric sulphate, $Fe_2(SO_4)_3$, corresponding to 9.5–10.5 p. c. of iron. *Tests:* 1. Aqueous dilution (1 in 20) with: (*a*) ammonia water—brownish-red precipitate; (*b*) potassium ferrocyanide T. S.—blue precipitate; (*c*) barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. *Impurities:* Nitric acid, ferrous salt.

PROPERTIES AND USES.—May use cautiously like preceding, but is more irritating, less astringent, externally may cause sloughing sores owing to contained acid; its greatest service is that it forms the basis of our scale salts, also some other iron compounds.

PREPARATIONS.—(Unoff.): *Liquor Ferri Acetatis*, 80 Gm., ammonia water 85, dilute each, add former to latter, add washed magma (portions) to glacial acetic acid 26, dist. water q. s. 100. *Liquor Ferri Citratis*—84 Gm., add to ammonia water 88 (both diluted), wash magma, add citric acid 30, heat, stir, evaporate to 100. *Liquor Ferri Nitratis*—14.5 Gm., ammonia water 16, both diluted, mix, wash magma, dissolve in nitric acid 7.1, add dist. water q. s. 100. *Magma Ferri Hydroxidi*, 100 Ml. (Cc.), added to ammonia water 138 (both much diluted), stirring constantly, wash precipitate.

Ferri Carbonas Saccharatus. Saccharated Ferrous Carbonate, $FeCO_3$.—(Syn., Ferr. Carb. Sacch., Carbonas Ferrosus Saccharatus; Fr. Saccharure (de Carbonate ferreux) de Proto-carbonate de Fer; Ger. Ferrum carbonicum saccharatum, Zuckerhaltiges (Kohlensaures Eisen) Ferrocarbonat.)

Manufacture: Dissolve ferrous sulphate 50 Gm. in hot distilled water 200 Ml. (Cc.), + few drops of diluted sulphuric acid; dissolve sodium bicarbonate 35 Gm. in distilled water 500 Ml. (Cc.), filter both solutions and add former to latter in a large flask, wash precipitate, until only slight cloudiness with barium chloride T. S.; by filling flask several times with hot distilled water, siphoning off each time the clear, supernatant liquid; drain, transfer to a dish, mix intimately with sugar 70 Gm., sugar of milk 10 Gm., evaporate to dryness on water-bath, pulverize, mix with well-dried sugar q. s. 100 Gm.—$(FeSO_4 + 10H_2O) + 2NaHCO_3 = FeCO_3 + Na_2SO_4 + CO_2 + 11H_2O$; contains 15 p. c. of ferrous carbonate. It is a greenish-brown powder, gradually oxidized by contact with air, odorless, sweetish, ferruginous taste; partially soluble in water, completely on adding hydrochloric acid with evolution of carbon dioxide, forming clear, greenish-yellow liquid. *Impurities:* Sulphate, etc. Should be kept dark, in small, well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.), in pill.

Properties and Uses.—Takes the place of subcarbonate and the anciently used iron-rust in anæmia, chlorosis, neuralgia, chorea.

Massa Ferri Carbonatis. Mass of Ferrous Carbonate.—(Syn., Mass Ferr. Carb., Vallet's Mass, Pill of Carbonate of Iron, Vallet's Ferruginous Pills, Pilulæ Ferratæ Valleti; Pilula Ferri Carbonatis; Fr. Masse pilulaire de Vallet—de Carbonate ferreux, Pilules de Carbonate ferreux—ferrugineuses; Ger. Valletsche Pillenmasse, Pilulæ Ferri carbonici.)

Manufacture: Dissolve ferrous sulphate 100 Gm. and monohydrated sodium carbonate 46 Gm., each, in boiling distilled water 200 Ml. (Cc.); to iron solution add syrup 20 Ml. (Cc.), filter both solutions, cool; add gradually the iron solution to that of sodium, in a bottle of 500 Ml. (Cc.) capacity, frequently rotating bottle until carbonic acid gas no longer escapes; fill bottle with distilled water, cork, set aside for ferrous carbonate to subside, pour off supernatant liquid, wash precipitate with a mixture of syrup (1) and distilled water (19), by decantation, until washings no longer saline, drain, express, mix precipitate with clarified honey 38 Gm. and sugar 25 Gm., evaporate, with constant stirring, to 100 Gm.—$(FeSO_4 + 7H_2O) + (Na_2CO_3 + 10H_2O) = FeCO_3 + Na_2SO_4 + 17H_2O$; contains 35 p. c. of ferrous carbonate. It is greenish-gray when fresh, gradually deepening in color, but should not be brown the result of oxidation; often blackish-green on surface owing to escape of moisture. Dose, gr. 1–5 (.06–.3 Gm.), in pill, after meals.

Pilulæ Ferri Carbonatis. Pills of Ferrous Carbonate.—(Syn., Pil. Ferr. Carb., Chalybeate Pills, Blaud's Pills, Ferruginous Pills; Br. Pilula Ferri, Iron Pill, Pills of Iron; Fr. Pilules ferrugineuses (chalybés) de Blaud (Griffith); Ger. Blaudsche (Griffithsche) Pillen.)

Manufacture: Rub in a mortar potassium carbonate 8 Gm. with glycerin and water, each 5 drops, add granulated ferrous sulphate 16 Gm. and sugar 4 Gm., previously triturated to uniform powder, rub mass thoroughly until greenish, and when reaction complete add tragacanth 1 Gm., althæa 1 Gm., water q. s. 100 pills; each pill contains 1 gr. (.06 Gm.) of ferrous carbonate in a fresh state, resulting from double decomposition of the two salts. Dose, 1–2 pills.

Properties and Uses.—Tonic in debility of digestive organs; chlorosis, hysteria, phthisis, chronic catarrh.

Ferri Hydroxidum cum Magnesii Oxido. Ferric Hydroxide with Magnesium Oxide.—(Syn., Ferr. Hydrox. cum Mag. Oxid., Arsenic Antidote, Ferric Hydrate with Magnesia; Fr. Contre-poison de l'Arsenic; Ger. Gegengift (des Arseniks) der Arsenigsaure.)

Manufacture: Mix solution of ferric sulphate 40 Ml. (Cc.) with water 125 Ml. (Cc.), keep liquid in large, well-stoppered bottle; rub magnesium oxide 10 Gm. with water to a smooth, thin mixture, transfer to a bottle holding 1000 Ml. (Cc.), and fill it three-fourths with water and keep tightly stoppered; when wanted for use, shake latter mixture to a thin, creamy consistence, and slowly add to it the diluted ferric sulphate solution, shake until smooth. The magnesium oxide 10 Gm. may be replaced by 300 Ml. (Cc.) of magnesia magma, diluting with water q. s. for required volume. Always keep the two solutions on hand in separate bottles, ready for immediate use, so that antidote may quickly be prepared.

PROPERTIES AND USES.—Solely as an antidote to arsenic-poisoning, when it may act by combination, although it is believed to envelop largely the poison mechanically, thereby preventing its absorption; stomach should be emptied shortly after its administration, and should always be prepared freshly, as it becomes inefficient by age. Dose, ℥iv–6; 120–180 Ml. (Cc.).

Ferri et Ammonii Citras. Iron and Ammonium Citrate.—(Syn., Ferr. et Ammon. Cit., Soluble Ferric Citrate, Ammonio-ferric Citrate, Ferro-ammonium Citricum; Fr. Citras Ammonico-ferricus, Citrate de Fer et d'Ammoniaque (de Fer Ammoniacal); Ger. Citronensaures Eisenoxyd Ammonium (Ammoniak), Ferriammoncitrat.)

Manufacture: Add solution of ferric citrate 100 Ml. (Cc.) to ammonia water 40 Ml. (Cc.), evaporate mixture at 60° C. (140° F.) to syrup, dry on glass. It is in thin, transparent, garnet-red scales, odorless, saline, ferruginous taste, deliquescent, soluble in water, insoluble in alcohol, aqueous solution slightly acid or alkaline, chars into ferric oxide; contains 16–18 p. c. of Fe. *Tests:* 1. Heat with potassium hydroxide T. S.—brownish-red precipitate, ammonia evolved. 2. Aqueous solution + ammonia water—no precipitate, but darkens solution. *Impurities:* Ferric citrate, tartrate. Should be kept dark, in well-closed containers. Dose, gr. 2–5 (.13–.3 Gm.).

PREPARATION.—(Unoff.): *Vinum Ferri*, official 1880–1910; dissolve iron and ammonium citrate 4 Gm. in sherry wine 70 Ml. (Cc.), add tincture of sweet orange peel 6 Ml. (Cc.), syrup 10 Ml. (Cc.), sherry wine q. s. 100 Ml. (Cc.), filter after several days, dose, ʒj–4 (4–15 Ml. (Cc.)).

PROPERTIES AND USES.—Tonic; chlorosis, anæmia, etc.

Ferri et Quininæ Citras. Iron and Quinine Citrate.—(Syn., Ferr. et Quin. Cit., Ferri et Quininæ Citras Solubilis, U. S. P. 1900, Soluble Iron and Quinine Citrate; Fr. Citrate de Fer et de Quinine (soluble); Ger. (Lösliches Eisenchinincitrat.)

Manufacture: Dissolve by heat ferric citrate 85 Gm. in distilled water 160 Ml. (Cc.), add quinine (dried) 12 Gm. + citric acid 3 Gm., previously triturated with distilled water 20 Ml. (Cc.); stir until dissolved, and add ammonia water 50 Ml. (Cc.), constantly stirring, evaporate greenish-yellow liquid to syrup, dry on glass. It is in thin, transparent scales, greenish, golden-yellow, odorless, bitter, mildly ferruginous taste, deliquescent, soluble in water, partly in alcohol, aqueous solution acid, chars into ferric oxide; contains 11.5 p. c. of anhydrous quinine, and 13 p. c. of iron. *Tests:* 1. Aqueous solution + ammonia water—white, curdy precipitate, liquid deeper color. 2. Heated with potassium hydroxide T. S.—brown precipitate, ammonia evolved. *Impurities:* Ferric citrate, tartrate. Should be kept dark, in amber-colored, well-stoppered bottles. Dose, gr. 3–10 (.2–.6 Gm.), in pill or solution, before meals.

Preparation.—(Unoff.): *Vinum Ferri Amarum,* official 1880–1910; iron and quinine citrate 5 Gm., tincture of sweet orange peel 6 Ml. (Cc.), syrup 20 Ml. (Cc.), sherry wine q. s. 100 Ml. (Cc.), dose, ʒj–2 (4–8 Ml. (Cc.)).

Properties and Uses.—Tonic; combines the properties of both ingredients in convenient form; taken preferably in pills. Wine—mild ferruginous tonic; anæmia, debility.

Ferri Phosphas. Ferric Phosphate.—(Syn., Ferr. Phos., Ferri Phosphas Solubilis, U. S. P. 1900, Soluble Ferric Phosphate, Ferri et Sodii Citrophosphas, Ferrum Phosphoricum cum Natrio Citrico; Fr. Citrophosphate de Fer. et de Soude; Ger. Natriumferricitrophosphat.)

Manufacture: Dissolve, by heat, ferric citrate 50 Gm. in distilled water 100 Ml. (Cc.), add sodium phosphate (uneffloresced) 55 Gm., stirring until dissolved, evaporate to syrup, dry on glass. It is in thin, bright green, transparent scales, odorless, acidulous slightly saline taste, permanent in the dark and dry air, soon darkens unprotected, soluble in water, insoluble in alcohol; aqueous solution slightly acid; contains 12 p. c. of iron. *Tests:* 1. Aqueous solution + ammonia water—reddish-brown color. 2. Boil with potassium hydroxide T. S. —brownish-red precipitate, without evolving ammonia. *Impurities:* Pyrophosphate, etc. Should be kept dark, in amber-colored, well-stoppered bottles. Dose, gr. 3–10 (.2–.6 Gm.).

Preparations.—(Unoff.): *Elixir,* 3.5 p. c., +. *Ferrated Elixir of Calisaya,* 3.5 p. c., + dist. water 6, elixir of cinchona alkaloids q. s. 100. *Elixir Ferri, Quininæ et Strychninæ Phosphatum,* official 1900–1910; ferric phosphate 17.5 Gm., quinine 8.75 Gm., strychnine .275 Gm., phosphoric acid 2 Ml. (Cc.), ammonium carbonate 9 Gm., acetic acid 28.65 Gm., alcohol 60 Ml. (Cc.), distilled water 50 Ml. (Cc.), aromatic elixir q. s. 1000 Ml. (Cc.), dose, ʒj–2 (4–8 Ml. (Cc.)). *Glyceritum Ferri, Quininæ et Strychninæ Phosphatum,* official 1900–1910; ferric phosphate 8 Gm., strychnine .08 Gm., quinine 10.4 Gm., water 10 Ml. (Cc.), glycerin 50 Ml. (Cc.), dose, ♏xv–60 (1–4 Ml. (Cc.)). *Syrupus Ferri, Quininæ et Strychninæ Phosphatum,* official 1880–1910; ferric phosphate 2 p. c., + quinine 2.6, strychnine .02, or glycerite of the phosphates of iron, quinine and strychnine 25 Ml. (Cc.), syrup q. s. 100 Ml. (Cc.); dose, ℥j–2 (4–8 Ml. (Cc.)).

Allied Products:

1. *Ferri Ramenta. Iron Filings,* official 1830–1860.—Such as are wholly attracted by the magnet. Owing to the magnet not being a perfect purifier, as it attracts and takes up other substances, and owing to so much copper being present in nearly all samples, they are no longer used officially.

2. *Ferri Lactas. Ferrous Lactate,* $Fe(C_3H_5O_3)_2.3H_2O$.—Obtained by digesting iron filings 15 Gm. in lactic acid 30 Ml. (Cc.) + water 500 Ml. (Cc.) until action ceases, filtering, crystallizing, or by double decomposition between ferrous sulphate and calcium lactate. It is a greenish-white powder or in crystalline masses, slightly characteristic odor, mild, sweet, ferruginous taste, soluble in water (40), insoluble in alcohol. *Impurities:* Metals, sulphate, chloride, citrate, tartrate, malate, sugar, gum, butyric acid, carbonizable substances. Chalybeate, tonic. Dose, gr. 1–5 (.06–.3 Gm.), pill, lozenge, bread, water, syrup; Elixir, 1.75 p. c., + potassium citrate 5.25, +. Syrupus Ferri Lactophosphatis 1.75 p. c., phosphoric acid 1.75, +.

3. *Ferri Bromidum. Ferrous Bromide,* $FeBr_2.6H_2O$.—Obtained by digesting bromine (2) iron wire or filings (1), water (10), until liquid becomes greenish, filtering, evaporating. It is a yellowish, styptic, deliquescent, soluble salt, very poisonous, should be employed cautiously. Dose, gr. 1–3 (.06–.2 Gm.); syrup, ♏xv–30 (1–2 Ml. (Cc.)).

4. *Ferri Sulphidum. Ferrous Sulphide,* FeS.—Obtained by melting together small pieces of iron and sublimed sulphur; used only for generating hydrogen sulphide.

5. *Ferri Iodidum Saccharatum. Saccharated Ferrous Iodide.*—Obtained by mixing iron, as fine bright wire, 6 Gm., iodine 17 Gm., distilled water 20 Ml. (Cc.) shaking occasionally until green color appears, filtering into sugar of milk 40 Gm., evaporating to dryness with constant stirring, then adding reduced iron 1 Gm. to retard decomposition, and sugar of milk q. s. 100 Gm. It is a yellowish-white powder, very hygroscopic, odorless, sweet, ferruginous taste, soluble in water (7), partially soluble in alcohol. *Impurities:* Salts of fixed alkalies, free iodine. Should be kept cool, in the dark, in dried, well-stoppered bottles. May be made by simply evaporating *Syrupus Ferri Iodidi,* but on the continued application of heat a part of the iodine would be liberated, and a darker, less soluble, product result, through the formation of ferric oxide. Dose, gr. 1–5 (.06–.3 Gm.), ter die.

6. *Ferri Oxalas. Ferrous Oxalate,* FeC_2O_4,H_2O, official 1880–1890.—Obtained by dissolving ferrous sulphate 62 Gm. in water 1000 Ml. (Cc.), also oxalic acid 28 Gm. in water 500 Ml. (Cc.), filter and mix two solutions with agitation, wash and dry precipitate. It is a yellow, crystalline powder, odorless, nearly tasteless, permanent, slightly soluble in water, soluble in HCl or hot diluted H_2SO_4. Very similar

to all other ferruginous compounds, but weak, hence little used. Dose, gr. 1–5 (.06–.3 Gm.).

7. *Ferri Subcarbonas. Subcarbonate of Iron,* $Fe_2O_3,Fe_2(OH)_6$, official 1840–1880.—Made by mixing iron sulphate 225 Gm., dissolved in water 2000 Ml. (Cc.), with sodium carbonate 250 Gm., dissolved in water 2000 Ml. (Cc.), wash and dry the precipitate without heat. It is a reddish-brown powder, soluble in diluted HCl with slight effervescence; when dried by heat dissolves with difficulty in diluted HCl, as it then consists chiefly of the oxyhydrate, $Fe_2O_2,(OH)_2$. On exposure takes up oxygen, thus losing its original character and becoming a more insoluble oxide. Chalybeate tonic; anæmia, anæmic chlorosis, chorea, neuralgia, ulcers, in emergency for arsenous acid poisoning—acts here mechanically and by combination; now replaced by ferri carbonas saccharatus. Dose, gr. 5–15 (.3–1 Gm.).

8. *Ferri Oxidum Saccharatum. Saccharated Ferric Oxide.*—Obtained by adding to solution of ferric chloride 30 (well diluted), monohydrated sodium carbonate 11.2 (dissolved), wash magma, add sugar 50, + sodium hydroxide solution to clarify, evaporate to dryness; Syrupus Ferri Saccharati Solubilis, 4.15 p. c.

9. *Ferri Hypophosphis. Ferric Hypophosphite,* $Fe(PH_2O_2)_3$, official 1870–1910.—Obtained by adding a solution of sodium or calcium hypophosphite to a solution of ferric chloride or sulphate, washing and drying precipitate with moderate heat—$6NaPH_2O_2 + Fe_2Cl_5 = 2Fe(PH_2O_2)_3 + 6NaCl$; may also be made from iron sulphate and calcium hypophosphite, when the solution contains ferrous hypophosphite, which upon evaporation becomes ferric. It is a white, grayish-white powder, odorless, nearly tasteless, permanent, soluble in water (2300), when heated get inflammable hydrogen phosphide gas and ferric pyrophosphate; oxidized by nitric acid; contains 98 p. c. of pure salt—21.8 p. c. of iron. Should be kept in well-stoppered bottles. Dose, gr. 3–10 (.2–.6 Gm., in pill, powder, syrup. Anæmia, defective nerve-nutrition. Liquor Ferri Hypophosphitis, 16.5 p. c., + potassium citrate 21.5, glycerin 15, water q. s. 100. Elixir, 1.65 p. c., + potassium citrate 2.15, +. Syrup, 1.75 p. c., + potassium citrate 2.5, +.

10. *Ferri Arsenas. Iron Arsenate,* $3Fe(FeO)AsO_4,16H_2O$.—Obtained by dissolving separately in water sodium arsenate and ferrous sulphate, mixing, neutralizing solution with sodium bicarbonate, wash, dry precipitate. A greenish amorphous powder, insoluble in water; contains 31.68 p. c. As_2O_3 + 26.4 p. c. water. Dose, gr. $\frac{1}{10}$–$\frac{1}{2}$ (.006–.03 Gm.).

11. *Ferri et Ammonii Tartras. Iron and Ammonium Tartrate,* official 1860–1910.—Obtained by adding solution of ferric sulphate 100 Ml. (Cc.), diluted with 1300 Ml. (Cc.) of water, to ammonia water 110 Ml. (Cc.), previously diluted with 250 Ml. (Cc.) of water, wash precipitate; dissolve tartaric acid 14.5 Gm. in distilled water 200 Ml. (Cc.), neutralize with ammonia water, add tartaric acid 14.5 Gm., heat until dissolved, then add the precipitate (ferric hydroxide) in portions; when dissolved filter, evaporate to syrup, dry on glass. It

is in thin, transparent, garnet-red, reddish-brown scales, odorless, sweetish, ferruginous taste, deliquescent, soluble in water, insoluble in alcohol; contains amount of salt corresponding to 13 p. c. of metallic iron. Mild chalybeate; anæmia, etc. Should be kept dark, in well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.).

12. *Ferri et Potassii Tartras. Iron and Potassium Tartrate,* official 1830–1910.—Obtained by preparing ferric hydroxide as in ferri et ammonii tartras; heat potassium bitartrate 38 Gm. with distilled water 300 Ml. (Cc.), gradually add the precipitate (ferric hydroxide) in portions, stir, when dissolved filter, let stand 24 hours, stir to incorporate the precipitate, add ammonia water q. s. to dissolve precipitate, evaporate to syrup, dry on glass. It is in thin, transparent, garnet-red, redish-brown scales, odorless, sweetish, ferruginous taste, deliquescent, soluble in water, insoluble in alcohol; contains amount of salt corresponding to 15 p. c. of metallic iron. One of the richest preparations in iron, most agreeably tasting, least constipating and least irritating to stomach and bowels of the iron salts. Should be kept dark, in well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.), ter die.

13. *Ferri Hydroxidum. Ferric Hydroxide,* $Fe(OH)_3$, official 1830–1910.—Obtained by diluting ammonia water 138 Ml. (Cc.) with water 500 Ml. (Cc.), constantly stirring, and to this add solution of ferric sulphate 100 Ml. (Cc.), previously diluted with water 1000 Ml. (Cc.), wash precipitate several times with water 1000 Ml. (Cc.), finally mix it with water q. s. 300 Gm., if order reversed, have formed basic ferric sulphate; when wanted for arsenous acid poisoning in great haste, much washing may be omitted, as the retained ammonia serves as a stimulant, thus neutralizing some of the depressing effects of the poison. It is a brownish-red magma, soluble in hydrochloric acid without effervescence. Largely as an antidote to arsenic-poisoning, a very good substitute for official: *Ferri Hydroxidum cum Magnesii Oxido.* Dose, ʒj–4 (4–15 Gm.).

14. *Ferri Valeras. Ferric Valerate,* $Fe_2(C_5H_9O_2)_6$, official 1880–1900.—Obtained by precipitating diluted solution ferric sulphate (or chloride) with cold solution sodium valerate (valerianate), washing, drying precipitate. It is a dark brick-red amorphous powder, varying composition, valerian odor, permanent, insoluble in cold water, soluble in alcohol; chars into ferric oxide, contains 15–20 p. c. of metallic iron. Chalybeate tonic; anæmia, nervous exhaustion, hysteria, diabetes insipidus. Dose, gr. 1–5 (.06–.3 Gm.).

15. *Ferri Ferrocyanidum. Ferric Ferrocyanide,* $Fe_4 3Fe(CN)_6$, official 1830–1880.—Obtained by adding an aqueous solution potassium ferrocyanide to diluted solution ferric sulphate. It is dark blue, insoluble in water; poor chalybeate—its iron inert, cyanogen non-poisonous. Dose, ʒss–1 (2–4 Gm.).

16. *Ferrum Dialysatum. Dialyzed Iron.*—Obtained by saturating aqueous solution of ferric chloride with fresh ferric hydroxide, putting into a dialyzer and suspending in water; all the acid passes through the septum, but very little iron. Used like *Tinctura Ferri Chloridi,* with

the advantages of having no styptic taste, not staining teeth, nor constipating. Dose, ♏v–30 (.3–2 Ml. (Cc.)), diluted with water.

17. *Ferri Glycerophosphas. Ferric Glycerophosphate,* $Fe_2(C_3H_5(OH)_2PO_4)_3$.—Obtained by dissolving fresh ferric hydroxide in glycerophosphoric acid, evaporating, spreading on glass plates, drying. It is in yellowish-green transparent, amorphous scales, powder, odorless, nearly tasteless, soluble in water (2), insoluble in alcohol. Dose, gr. 3–10 (.2–.6 Gm.).

18. *Ferri Citras. Ferric Citrate,* $Fe_2(C_6H_5O_7)_2,6H_2O$, official 1850–1910.—Obtained by dissolving fresh ferric hydroxide in water + citric acid, concentrating on water-bath at 60° C. (140° F.) to syrupy consistence, spreading on glass plates to dry in dust-proof closets; higher temperature prevents scaling and reduces to ferrous compound; yield 42–44 p. c., by weight, of solution used. It is in thin, transparent, garnet-red scales, odorless, slight ferruginous taste, soluble in water, insoluble in alcohol, chars into ferric oxide; contains pure salt corresponding to 16 p. c. of metallic iron. *Impurities:* Alkali citrates, tartrates. Mild tonic; delicate stomachs, children, with or without food. Should be kept dark, in well-stoppered bottles. Dose, gr. 5–15 (.3–1Gm.).

19. *Ferri Pyrophosphas. Ferric Pyrophosphate,* official 1860–1910 (Ferri Pyrophosphas Solubilis): ferric citrate 50 Gm., sodium pyrophosphate 50 Gm., water 100 Ml. (Cc.), evaporate solution to syrup, dry on glass. It is in thin apple-green transparent scales, odorless, acid, saline taste, darkens with age, soluble in water, insoluble in alcohol; contains amount of salt corresponding to 10 p. c. of metallic iron. Valuable chalybeate; anæmia, etc. Should be kept dark, in well-stoppered, amber-colored bottles. Dose, gr. 1–5 (.06–.3 Gm.); Elixir, 3.5 p. c., +; Elixir Ferri Pyrophosphatis, Quininæ et Strychninæ; Elixir Ferri, Quininæ et Strychninæ.

20. *Ferri et Strychninæ Citras. Iron and Strychnine Citrate,* official 1870–1910.—Obtained by dissolving iron and ammonium citrate 98 Gm. in distilled water 100 Ml. (Cc.); dissolve strychnine 1 Gm. + citric acid 1 Gm. in distilled water 20 Ml. (Cc.), mix solutions, evaporate to syrup, dry on glass. It is in thin, transparent, garnet-red, yellowish-brown scales, odorless, bitter, ferruginous taste, deliquescent, soluble in water, partially in alcohol; contains .9–1 p. c. of strychnine, and amount of salt corresponding to 16 p. c. of metallic iron; chars into ferric oxide, which should not be alkaline (abs. of citrates, tartrates of alkali metals). Should be kept dark, in well-stoppered bottles. Dose, gr. 1–5 (.06–.3 Gm.), in pill, solution.

21. *Ferri Peptonas. Iron Peptonate.*—Obtained by mixing solution of dialyzed iron (24) with water (200), adding this, constantly stirring, to dry peptone (2) dissolved in water (200); add to this 1.5 p. c. solution of sodium hydroxide to precipitate iron peptonate; contains 25 p. c. of iron. Chlorosis, anæmia. Has the advantages of slight astringency and corrosive effect upon the teeth, mucous membranes, etc. Dose, gr. 3–10 (.2–.6 Gm.).

Condensed Table giving some Basal Iron Preparations and Products therefrom; each single one, or set included within bracket, to right of its equation mark being manufactured from that individual product preceding it.

Ferrum =
- I. Liq. Fe Chlor. =
  - 1. Ferri Chloridum.
  - 2. Tr. Fe Chlor. = Liq. Fe et Am. Acetatis (Basham's Mixture), 2 p. c.
  - 3. Fe Hypophosphis (Pp. with Na Hypophosphite).
- II. Syr. Fe Iod. = Fe Iod. Saccharatum (20 p. c. FeI_2) = Pil. Fe Iod. (Blancard's).
- III. Fe Lactate = Syr. Hypophosphitum cum Ferro, 1 p. c.
- IV. Fe Sulph. =
  - 1. Fe Sulph. Exsic. = Pil. Aloes et Ferri.
  - 2. Fe Sulph. Gran.
  - 3. Fe Oxalas.
  - 4. Liq. Fe Subsulph.
  - 5. Liq. Fe Tersulphatis. =
    - 1. Fe et Am. Sulph.
    - 2. Liq. Ferri Citratis. =
      - 1. Fe Cit. =
        - 1. Fe et Quin. Cit.
        - 2. Fe et Quin. Cit. Sol. = Vin. Fe Amara.
        - 3. Fe Phos. Sol. = Elix., Glyc. and Syr. Fe, Quin. et S, Phos.
        - 4. Fe Pyrophos. Sol.
      - 2. Fe et Am. Cit. =
        - 1. Fe et Strych. Cit.
        - 2. Vin Ferri.
    - 3. Fe et Am. Tart.
    - 4. Fe et K Tart.
    - 5. Fe Hydroxidum. =
      - 1. Reductum.
      - 2. Emplastrum.
      - 3. Trochisci.
    - 6. Fe Hydroxidum cum MgO.
    - 7. Fe Valeras (Valerianas).
    - 8. Liq. Fe Nit.
    - 9. Liq. Fe Acet.
    - 10. Fe Ferrocyanidum.
    - 11. Ferrum Dialysatum.
    - 12. Fe Glycerophosphas.
  - 6. Fe Carb. Sacch.
  - 7. Fe Subcarb.
  - 8. Massa Fe Carb.
  - 9. Mist. Fe Carb.
  - 10. Pil. Fe Carb.
  - 11. Fe Hypophosphis.
  - 12. Fe Arsenas.
- V. Fe Brom.
- VI. Syr. Fe Brom. (10 p. c. $FeBr_2$).
- VII. Fe Sulphidum.

MANGANUM. MANGANESE.

$Mn^{ii+vi} = 54.93.$

The element manganese (L. corrupt. of *magnes*, from resemblance to the magnet, or from magnesia transposed, as both were confounded until 1740) is not of great importance in medicine; it occurs natively in considerable quantities as black oxide, MnO_2 (pyrolusite, hausmannite, braunite), as sesquioxide, Mn_2O_3, as carbonate, $MnCO_3$; from this latter the metal may be obtained by heating with charcoal—$MnCO_3 + 2C = Mn + 3CO$. It resembles iron very closely, but oxidizes easier, is harder and more brittle; sp. gr. 7.20; gives only one official salt.

Tests for Manganese Salts: 1. With ammonium sulphide get flesh-colored precipitate. 2. Na_2CO_3 or K_2CO_3 gives white precipitate insoluble in excess of ammonium carbonate. 3. Borax bead is violet or amethyst. 4. Heated with $Na_2CO_3 + NaNO_3$ get bluish-green mass, forming with water a green solution which turns red with an acid.

Mangani Dioxidum Præcipitatum. Precipitated Manganese Dioxide.—(Syn., Mangan. Diox. Præc., Mangani Dioxidum; Fr. Bioxyde (Peroxyde) de Manganèse précipitaté; Ger. Präcipitistes Mangandioxyd.)

Manufacture: Dissolve manganese sulphate 50 Gm. in 1000 Ml. (Cc.) distilled water; add to ammonia water 250 Ml. (Cc.) an equal volume distilled water, mix this with solution of hydrogen dioxide 250 Ml. (Cc.), previously diluted with equal volume distilled water, pour this slowly into solution of manganese sulphate, let stand an hour, frequently stirring, wash precipitate with hot distilled water, drain, dry. It is a heavy, very fine, black powder, odorless, tasteless, permanent, insoluble in water, alcohol; heating with hydrochloric acid converts it into manganous chloride, with evolution of chlorine; at red heat gives off oxygen, being converted into reddish-brown manganous manganic oxide, Mn_3O_4; contains chiefly manganese dioxide, with small amounts of other oxides of manganese, corresponding to 80 p. c. of the salt, MnO_2. *Tests:* 1. Boil .1 Gm. with 2 drops of hydrochloric acid + lead peroxide .5 Gm. + nitric acid 5 Ml. (Cc.), + distilled water 5 Ml. (Cc.)—liquid reddish-violet color. *Impurities:* Insoluble substances. Dose, gr. 3–10 (.2–.6 Gm.).

Properties and Uses.—Tonic, alterative, after prolonged usage may act as cumulative poison, causing staggering, paraplegia; good in syphilis, chlorosis, scurvy, skin diseases, itch, porrigo, stomach pains, pyrosis, gastralgia, simple ulcers. Acts solely as a coating to stomach, like bismuth salts.

Allied Salts:

1. *Mangani Dioxidum. Manganese Dioxide,* MnO_2, official 1860–1900.—This is the native crude manganese dioxide, containing 66 p. c. of pure dioxide, MnO_2; it is a heavy, grayish-black, gritty powder, odorless, tasteless, permanent, insoluble in water, alcohol; soluble in sulphuric or hydrochloric acid. It is important: 1, for liberating

chlorine from HCl or NaCl in making bleaching-powder, mercuric chloride, etc.; 2, for oxygen in laboratory work; 3, for furnishing manganese salts; 4, for black glazing to pottery; 5, for freeing glass from iron coloration; 6, for mixing with iron to furnish the best steel; 7, in veterinary practice.

2. *Mangani Sulphas. Manganese Sulphate,* $MnSO_4 + 4H_2O$, official 1860–1910.—Obtained by forming thin magma of manganese dioxide and sulphuric acid, boiling, evaporating to dryness, heating to redness (to decompose iron sulphate), cooling, treating with water, evaporating filtrate to crystallization. It is in pale rose-colored, translucent, tetrahedral prisms, odorless, slightly efflorescent, bitter, astringent taste, soluble in water (1), insoluble in alcohol; contains 38 p. c. of water, 62–68 p. c. of pure salt. *Impurities:* Heavy metals, iron, zinc, magnesium, salts of alkalies. Tonic, cholagogue, styptic, large doses sedative to nerves and circulation, poisonous; no longer considered a good substitute for iron in chlorosis, anæmia, impoverished system; ointment an irritant to enlarged glands, swollen joints, etc. Should be kept in well-stoppered bottles. Dose, tonic, gr. 3–10 (.2–.6 Gm.), pill, solution.

3. *Mangani Hypophosphis. Manganese Hypophosphite,* $Mn(PH_2O_2)_2 + H_2O$, official 1900–1910.—Obtained by mixing calcium hypophosphite (1) in solution, with manganese sulphate (1.31) in solution, stirring, setting in warm place for calcium sulphate to subside, filtering, evaporating, crystallizing. It is a pink granular or crystalline powder, odorless, nearly tasteless, permanent, soluble in water (6.6), nearly insoluble in alcohol; contains 97 p. c. of pure salt. *Impurities:* Arsenic, calcium, sulphate, carbonate, phosphate. Used similar to calcium hypophosphite. Should be kept in well-stoppered bottles. Dose, gr. 3–10 (.2–.6 Gm.).

4. *Mangani Citras Solubilis. Soluble Manganese Citrate,* $Mn_3(C_6H_5O_7)_2$.—Manganous citrate rendered soluble by sodium citrate. It is a yellowish, pinkish-white powder, translucent scales, odorless, bitter, astringent; soluble in water (4); contains 49–51 p. c. of pure salt.

5. *Mangani Glycerophosphas Solubilis. Soluble Manganese Glycerophosphate,* $MnC_3H_7PO_6$.—Manganese glycerophosphate rendered soluble by citric acid. It is a yellowish, pinkish-white powder, odorless, acid taste; soluble in water (4); contains 70–75 p. c. of pure salt.

CHROMIUM.

$Cr^{ii+vi} = 52.$

The element chromium (Gr. χρῶμα, color, + *ium*—*i. e.*, salts are colored) is not of much service in medicine, as it enters into only one official compound. Natively it occurs mostly as chrome iron ore or chromite, FeO,Cr_2O_3, having analogous composition to magnetic iron ore, FeO,Fe_2O_3; forms two basic oxides, *chromous,* CrO, and *chromic,* Cr_2O_3, and an acid oxide, trioxide, CrO_3 (official); there is also the dioxide, CrO_2, and trichromic tetroxide, Cr_3O_4.

Tests for Chromium Salts: 1. NaOH, KOH, NH_4OH, and NH_4SH will each precipitate green chromic hydroxide, $Cr_2(OH)_6$. 2. Soluble lead salts precipitate lead chromate (chrome yellow), $PbCrO_4$, insoluble in acetic acid, soluble in HCl and NaOH.

Chromii Trioxidum. Chromium Trioxide, CrO_3.—(Syn., Chrom. Triox., Chromic Acid (Anhydride), Acidum Chromicum, Anhydrous Chromic Acid; Fr. Acide chromique; Ger. Acidum chromicum, Chromsäure.)

Manufacture: Heat together, to solution, potassium dichromate (30), water (50), sulphuric acid (77.5), let stand 12 hours, drain crystals—$K_2Cr_2O_7 + 2H_2SO_4 = 2CrO_3 + 2KHSO_4 + H_2O$. Chromic acid proper, H_2CrO_4, like arsenous and carbonic acids, can exist only in solution and upon evaporating this the acid becomes anhydride. It is in small, needle-shaped crystals, rhombic prisms, dark purplish-red, metallic lustre, odorless, destructive to animal and vegetable tissues, deliquescent, soluble in water (.6), boiling water (.5); decomposes in contact with organic solvents (alcohol, ether, glycerin), sometimes with dangerous violence (liberated oxygen); contains 95 p. c. of the salt. *Tests:* 1. Heat—dark, black, restored on cooling; fuses at 193° C. (380° F.) to reddish-brown liquid, which on cooling—dark red, brittle mass (often enclosing cavities filled with crystals), furnishing a scarlet powder. 2. Decomposes at 250° C. (482° F.) into green chromic oxide and free oxygen; protracted heating—residue (chromic oxide); warmed with hydrochloric acid—evolves chlorine. *Impurities:* Sulphuric acid, etc. Should be kept in glass-stoppered bottles, and not brought in contact with organic substances, as serious accidents might result. Dose, gr. $\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 Gm.).

PREPARATION.—(Unoff.): *Liquor Acidi Chromici* (Br.), 25 p. c.

PROPERTIES AND USES.—Antiseptic, disinfectant, deodorant, escharotic, astringent; coagulates albumin. Used externally on growths in the mouth, larynx, pharynx, nasal passages (polypi), rhinitis, gangrene, scorbutic, syphilitic, or gangrenous ulcers, tumors, bites of rabid animals, poisoned wounds, tineæ, sycosis, lupus, sweating or tender feet, conjunctivitis, uterine hemorrhage, leucorrhœa, gonorrhœa, incontinence of urine. The aqueous solution is used mostly, 5–10 p. c., or even varying up to the strong acid.

Poisoning: Similar to potassium dichromate. Give emetics, then magnesium oxide or carbonate, sodium bicarbonate or borate, demulcent drinks (milk, egg-white), stimulants, heat, opium, stimulant enemas.

URANIUM.

$U^{ii+iv} = 238.5$.

The element uranium (fr. Gr. οὐρανός, the sky—*i. e.*, in allusion to the planet Uranus) was discovered in 1789 in a mineral long known and called pitch-blend (uraninite), but which was supposed to be an ore of zinc or iron. Metal may be obtained by decomposing the chloride with potassium or sodium, is permanent, and belongs to the chromium group having, however, the appearance and color of nickel, sp. gr. 18.7; forms two classes of compounds—*uranous*^{ii}, *uranic* (*uranyl*)^{iv}.

Tests for Uranium Salts.—1. Ammonium sulphide precipitates black uranic sulphide. 2. Hydrogen sulphide—no precipitate, but reduces yellow uranic to green uranous salt. 3. Alkaline carbonates—yellow precipitate. 4. Potassium ferrocyanide—reddish-brown precipitate; fused with borax—clear, yellow glass, greenish on cooling.

Uranii Nitras. Uranium Nitrate, $UO_2(NO_3)_2 + 6H_2O$.—(Syn., Uran. Nit., Uranyl Nitrate; Fr. Azotate de Urane; Ger. Urannitrat.)

Manufacture: Treat finely powdered pitch-blend with nitric acid, remove from solution the several associated metals (lead, barium, bismuth, iron, zinc, radium, polonium, etc.). It is in light yellow prisms, odorless, bitter, astringent taste, efflorescent, radio-active, soluble in alcohol, ether, water (1.2); aqueous solutions yellow, acid; contains 98 p. c. of pure salt. *Tests:* 1. Aqueous solution (1 in 20) with fixed alkali or ammonia water—yellow precipitate, insoluble in excess, but soluble in ammonium carbonate T. S.; with ammonium sulphide T. S.—dark brown precipitate; with sodium phosphate T. S.—yellow precipitate. 2. Aqueous solution 2 Ml. (Cc.) with sulphuric acid 2 Ml. (Cc.), cool, add crystal of ferrous sulphate—dark brown color around the crystal. *Impurities:* Heavy metals, iron, manganese, zinc, alkaline earths, uranous compounds, sulphate, etc. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 Gm.).

PROPERTIES AND USES.—Antidiabetic—diabetes, increases quantity and specific gravity of the urine, which contains albumin and glucose; violent poison, producing severe gastro-enteritis, nephritis, reduction of hæmoglobin, degeneration of bloodvessels and viscera, and oxygenating power of the blood; chiefly as an indicator, volumetric solutions, to detect morphine, arsenic and phosphoric acids; use cautiously.

ZINCUM. ZINC.

$Zn^{ii} = 65.37$.

(Syn., Speltrum; Fr. Speltre, Zinc; Ger. Zink.)

The metal zinc (Ger. *zinn*, tin, with which it formerly was confounded) is official as thin sheets, irregular, granulated pieces, molded into thin pencils, or as fine powder. Occurs natively as sulphide (zinc-blend), ZnS, as carbonate (calamine), $ZnCO_3$, as silicate, and as red oxide, and is obtained pure by subliming carbonate or oxide mixed with charcoal; the vaporized metal distils into receivers, where it solidifies. It is a bluish-white metal, crystalline fracture, in the form of thin sheets, irregular granulated pieces, molded into thin pencils, or in powder, sp. gr. 6.9–7.2 after it is rolled, tarnishes slowly with a film of oxide or carbonate, soluble in diluted sulphuric or hydrochloric acid with evolution of hydrogen and usually some insoluble residue; when heated at 100–150° C. (212–302° F.) becomes malleable, ductile;

above 200° C. (392° F.) becomes sufficiently brittle to be powdered in an iron mortar; at 414° C. (777° F.) melts, and at 940° C. (1724° F.) boils and may be distilled; contains 99 p. c. of pure metal. *Impurities:* Arsenic, antimony, phosphorus, sulphur.

Tests for Zinc Salts: 1. With ammonium sulphide—white precipitate (Zinc sulphide), soluble in mineral acids, not in acetic acid; only metal whose sulphide is white. 2. Caustic alkali, ammonia water—white precipitate (zinc hydroxide, $Zn(OH)_2$), soluble in excess of reagent. 3. Solution of potassium ferrocyanide—white precipitate (dist. from Mg, Al—no precipitate).

Zinci Chloridum. Zinc Chloride, $ZnCl_2$.—(Syn., Zinc.Chlor., Butter of Zinc; Fr. Chlorurētum Zincicum, Chlorure de Zinc; Ger. Zincum chloratum, Zinkchlorid, Chlorzink.)

Manufacture: Boil zinc in hydrochloric acid until dissolved—$2Zn + 4HCl = 2ZnCl_2 + H_4$; the solution contains also iron and lead, which may be removed by adding nitric acid to form ferric chloride, and then zinc carbonate to precipitate ferric hydroxide, filtering, evaporating; may also be made by evaporating official solution of zinc chloride to dryness, adding near the end a little hydrochloric acid to avoid largely the formation of oxychloride. It is a white, nearly white, granular powder, porcelain-like masses, or molded into pencils, odorless; so intensely caustic as to make tasting dangerous unless dissolved in much water, very deliquescent; soluble in glycerin, water (.25), alcohol (1.3); aqueous solution (1 in 10) acid; when heated to 115° C. (239° F.) fuses to a clear liquid; at higher temperature partly volatilizes in dense, white fumes, partly decomposes with a residue of zinc oxide; contains 95 p. c. of pure salt. *Tests:* 1. Aqueous solution (1 in 20) with potassium ferrocyanide T. S.—white, gelatinous precipitate; with ammonium sulphide T. S.—white precipitate; with silver nitrate T. S.—white, curdy precipitate, insoluble in nitric acid, soluble in ammonia water; with ammonium carbonate T. S.—white precipitate, redissolved in excess of reagent. 2. Add to 5 Ml. (Cc.) of aqueous solution (1 in 10) sufficient potassium hydroxide T. S. to redissolve precipitate first formed, warm—no odor of ammonia. *Impurities:* Heavy metals, ammonium salts, oxychloride, sulphate, etc. Should be kept in small, glass-stoppered bottles. Dose, gr. $\frac{1}{10}$–$\frac{1}{2}$ (.006–.03 Gm.).

PREPARATIONS.—1. *Liquor Zinci Chloridi.* Solution of Zinc Chloride. (Syn., Liq. Zinc. Chlor., Burnett's Disinfecting Fluid; Fr. Chlorure de Zinc liquide, Solute de Burnett; Ger. Flüssiges Chlorzink, Chlorzinklösung.)

Manufacture: Add hydrochloric acid 84 Gm. to granulated zinc 24 Gm. and distilled water 25 Ml. (Cc.), let stand until reaction ceases and acid saturated; pour off liquid, add nitric acid 1.2 Gm., heat at 115° C. (239° F.), until a portion removed and cooled, solidifies, cool, dissolve solidified mass in distilled water q. s. 100 Gm., then add precipitated zinc carbonate 1.2 Gm., agitate occasionally for 24 hours, set aside until clear by subsidence, separate clear solution by decantation or siphon; the nitric acid oxidizes iron into ferric chloride, while the zinc carbonate precipitates it as ferric oxide. It is a clear, colorless, odorless, aqueous liquid (solution), very astringent, metallic taste, acid reaction, sp. gr. 1.548; contains 48.5–52 p. c. of zinc chloride. Dose, ♏$\frac{1}{4}$–1 (.016–.06 Ml. (Cc.)); seldom used internally.

PROPERTIES AND USES.—Alterative, antispasmodic, astringent, escharotic, caustic, antiseptic, disinfectant. Internally—in scrofula, epilepsy, chorea, nervous troubles. Externally—in cancerous affections, tumors, cancers, aneurism, malignant and morbid growths, lupus, ulcers of uterus, etc., leucorrhœa, gonorrhœa, hemorrhagic endometritis, cystic tumors, nasal polypi, abscesses, scrofulous glands; to fill carious teeth, vascular and thickened conjunctiva. The liquor is the weaker form, used chiefly to deodorize and disinfect sewers, sinks, water-closets, hospitals, dissecting-rooms, etc., for embalming, to preserve anatomical subjects. When diluted (1 in 18) used as injection in gonorrhœa, leucorrhœa, etc., and as wash for ulcers, abscesses, to destroy putrid odor, etc. The salt itself sometimes applied for caustic purposes in pasty form, diluted 2–3–4–5 times with wheat flour, rye flour, or gluten.

Poisoning: Symptoms similar to violent corrosive irritant poison; corrosion of lips and mouth, burning in throat, stomach, bowels, vomiting (blood-stained), increased pulse and respiration, dyspnœa, paralysis, cold surface, dilated pupils, coma, convulsions, death. Give alkalies, alkali carbonates, emetics, soap, milk, albumin, anodynes, opium, flaxseed poultices to abdomen, stimulants, tannin.

Zinci Sulphas. **Zinc Sulphate,** $ZnSO_4 + 7H_2O$.—(Syn., Zinc. Sulph., Vitriolum Album, White Vitriol; Fr. Sulfas Zincicus, Sulfate de Zinc, Vitriol blanc, Couperose blanche; Ger. Zincum sulfuricum, Zinksulfat, Schwefelsaures Zinkoxyd, Weisser Vitriol, Galitzenstein.) This is the most important zinc salt.

Manufacture: Dissolve zinc in diluted sulphuric acid, remove iron and lead chlorides with nitric acid and zinc carbonate—$2Zn + 2H_2SO_4 + H_2O = 2ZnSO_4 + H_4 + H_2O$. It is in colorless, transparent rhombic crystals, granular, crystalline powder, odorless, astringent, metallic taste, efflorescent in dry air, soluble in water (.6), glycerin (2.5), insoluble in alcohol, aqueous solution (1 in 10) acid; rapidly heated melts; strongly ignited partly decomposes losing water and sulphuric acid; contains 55.86–58.65 p. c. of anhydrous zinc sulphate, corresponding to 99.5 p. c. of crystallized salt.

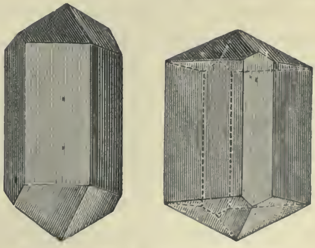


FIG. 460.—Zinc sulphate crystals.

Tests: 1. Aqueous solution (1 in 20) with potassium ferrocyanide T. S.—white, gelatinous precipitate; with ammonium sulphide T. S.

—white precipitate; with barium chloride T. S.—white precipitate. 2. Aqueous solution (1 in 10) with ammonium carbonate T. S.—white precipitate, redissolved in excess of reagent. *Impurities:* Heavy metals, arsenic, alkali, alkali earth salts, chloride, free acid. Should be kept in well-closed containers. Dose, tonic, astringent, gr. 1–3 (.06–.2 Gm.), in pill, after meals; emetic, gr. 10–15 (.6–2 Gm.), in tepid water.

PREPARATIONS.—(Unoff.): *Liquor Zinci et Alumini Compositus*—zinc sulphate, aluminum sulphate, each 20 Gm., betanaphthol .06, oil of thyme .2, water q. s. 100. *Liquor Zinci et Ferri Compositus*—zinc sulphate, aluminum sulphate, each 20 Gm., copper sulphate 6.5, hypophosphorous acid .4, oil of thyme .2, water q. s. 100. *Unguentum Zinci Oleatis* (Br.), 20 p. c.

PROPERTIES AND USES.—Tonic, astringent, emetic, gastric catarrh, nightsweats, epilepsy, chorea, croup, diphtheria, dysentery, typhoid fever, atonic dyspepsia, heart palpitation, spasmodic asthma, whooping-cough. Externally—aphthæ, conjunctivitis, gonorrhœa, ophthalmia, throat and larynx affections, hemorrhages, nasal polypi, ulcers, tumors, lupus, eczema, itching, to remove urethral caruncles, condylomata, warty excrescences. Caustic paste (℥j; 30 Gm. to glycerin ʒj; 4 Ml. (Cc.)), caustic ointment (℥j; 30 Gm. to lard ʒij; 8 Gm.), used as escharotic; injection, collyrium, and gargle ($\frac{1}{5}$–$\frac{1}{2}$ p. c.) are often useful.

Zinci Valeras. Zinc Valerate, $Zn(C_5H_9O_2)_2 + 2H_2O$.—(Syn., Zinc. Valer., Zinc Valerianate, Zinci Valerianas, Valerianas (Valeras) Zincicus; Fr. Valérianate (Valérate) de Zinc; Ger. Zincum valerianicum, Baldriansaures Zinkoxyd.)

Manufacture: Mix hot solutions of zinc sulphate and sodium valerate; sodium sulphate remains in solution while zinc valerate separates in scaly crystals coming to the surface, the yield increasing upon evaporation—$ZnSO_4 + 2NaC_5H_9O_2 = Zn(C_5H_9O_2)_2 + Na_2SO_4$. It is in white, pearly scales, white powder, odor of valeric acid, sweetish, astringent, metallic taste; on exposure slowly loses valeric acid becoming partially insoluble in water; soluble in alcohol (22), water (70), a basic insoluble salt tending to form; aqueous solution (1 in 100) acid; gently heated melts; at higher temperature decomposes emitting inflammable vapors with a residue chiefly zinc oxide; contains 99 p. c. of crystallized salt. *Tests:* 1. Dissolve .5 Gm. in a mixture of hydrochloric acid .5 Ml. (Cc.) and distilled water 9 Ml. (Cc.)—valeric (isovaleric) acid is liberated, floating on surface, as an oily layer. 2. Dissolve in ammonium carbonate T. S.—no residue. *Impurities:* Heavy metals, arsenic, acetate, butyrate. Should be kept in small, well-closed containers. Dose, gr. 1–3 (.06–.2 Gm.), in pill, mucilage, syrup.

PREPARATION.—(Unoff.): *Elixir*, 1.75 p. c., + citric acid 5.6, spirit of bitter almond 1, +, dose, ʒj–2 (4–8 Ml. (Cc.)).

PROPERTIES AND USES.—Antispasmodic, nervine, diabetes insipidus, neuralgia, epilepsy, chlorosis, nervous headache, vertigo, whooping-cough, convulsions, hysteria, chorea, cholera.

Zinci Carbonas Præcipitatus. Precipitated Zinc Carbonate, $2ZnCO_3,3Zn(OH)_2$(?).—(Syn., Zinc. Carb. Præc., Zincum Carbonicum, Carbonas Zincicus; Br. Zinci Carbonas; Fr. Hydrocarbonas Zincicus, Zincum Souscarbonate, Hydrocarbonate de Zinc; Ger. Zinkcarbonat, Kohlensaures Zinkoxyd.)

Manufacture: Add slowly a solution of zinc sulphate to a boiling solution of sodium carbonate, constantly stirring, thereby avoiding the formation of normal instead of basic salt, that which is desired—$5(ZnSO_4 + 7H_2O) + 5(Na_2CO_3 + 10H_2O) = 2ZnCO_3, 3Zn(OH)_2 + 3CO_2 + 5Na_2SO_4 + 82H_2O$. It is an impalpable, white powder, odorless, tasteless, permanent, insoluble in water, alcohol; soluble in diluted acids with copious effervescence, also in ammonia water, ammonium carbonate T. S.; strongly heated loses water and carbon dioxide, with a yellow residue, becoming white on cooling; it is the basic zinc carbonate of somewhat variable chemical composition, corresponding to 68 p. c. of zinc oxide. *Tests:* 1. Dissolve 1.5 Gm. in diluted sulphuric acid and distilled water, each 10 Ml. (Cc.), after effervescence ceases, filter; a portion with potassium ferrocyanide T. S.—white gelatinous precipitate; a portion with ammonium sulphide T. S.—white precipitate; a portion with ammonium carbonate T. S.—white precipitate, redissolved in excess of reagent. *Impurities:* Heavy metals, alkali, etc.

PROPERTIES AND USES.—Astringent, protective, absorbent, chiefly externally for healing blisters, superficial sores, intertrigo, abrasions; in ointment, which now is substituted for the once popular Turner's cerate, made from impure native carbonate—calamine; may simply dust the powder on inflamed surfaces.

Zinci Oxidum. Zinc Oxide, ZnO.—(Syn., Zinc. Oxid., Flores Zinci, Zinc-white, Nihil Album, Lana Philosophica; Fr. Oxydum Zincicum, Oxyde de Zinc; Ger. Zincum oxydatum (purum), Zinkoxyd, Philosophenwolle Zinkblumen.)

Manufacture: Heat precipitated zinc carbonate at 250–280° C. (482–536° F.) until all carbon dioxide and water expelled; the lower the heat the whiter, a red heat giving a yellow tint—$2ZnCO_3, 3Zn(OH)_2 = 5ZnO + 2CO_2 + 3H_2O$. It is a very fine, amorphous, white, yellowish-white powder, free from gritty particles, odorless, tasteless, gradually absorbs carbon dioxide from the air, insoluble in water, alcohol, soluble without effervescence in dilute acids, ammonia water, ammonium carbonate T. S.; strongly heated—yellow color, disappearing on cooling; contains when freshly ignited, 99 p. c. of pure salt. *Tests:* 1. Digest 1.3 Gm. in diluted hydrochloric acid and distilled water, each 10 Ml. (Cc.); with potassium ferrocyanide T. S.—white, gelatinous precipitate; with ammonium sulphide T. S.—white precipitate. *Impurities:* Heavy metals, alkali, etc. Dose, gr. 1–5 (.06–.3 Gm.), in pill, ter die.

PREPARATIONS.—1. *Unguentum Zinci Oxidi.* Ointment of Zinc Oxide. (Syn., Ung. Zinc. Ox., Zinc Ointment, Ointment of Zinc;

Br. Unguentum Zinci; Fr. Unguentum de Nihilo Albo, Pommade d'Oxyde de Zinc, Cérat épulotique; Ger. Unguentum Zinci, Zinksalbe.)

Manufacture: 20 p. c. Rub zinc oxide (free from gritty particles) 20 Gm. with melted benzoinated lard 20 Gm., in a previously warmed container, then incorporate benzoinated lard 60 Gm., previously melted; if necessary strain while warm, stir thoroughly until congealed.

Unoff. Preps.: Glycerogelatinum Zinci Durum, 10 p. c., + glycerinated gelatin 30, glycerin 25, dist. water 35. *Glycerogelatinum Zinci Molle,* 10 p. c., + glycerinated gelatin 20, glycerin 35, dist. water 35. *Pasta Zinci,* 24 p. c., + salicylic acid 2, starch 24, petrolatum 50. *Pasta Zinci Mollis,* 25 p. c., + precip. calcium carbonate 25, linseed oil 25, solution of calcium hydroxide 25. *Pasti Zinci Sulphurata,* 15 p. c., + precip. sulphur 10, purified siliceous earth 5, benzoinated lard 70.

PROPERTIES AND USES.—Antispasmodic, astringent, chorea, epilepsy, whooping-cough, gastric and intestinal catarrhs, hysteria, spasmodic asthma, delirium tremens, colliquative sweats, diarrhœa, dysentery, diabetes insipidus. Externally—burns, scalds, fissures of nipples or anus, chancroids, intertrigo, ulcers, leucorrhœa, skin eruptions, erysipelas, chronic ophthalmia, cosmetic, paint. Ointment is good form of application, having superseded the old Unguentum Tutiæ (tutty) made from impure zinc oxide—tutty (1 in 5).

Zinci Acetas. Zinc Acetate, $Zn(C_2H_3O_2)_2 + 2H_2O$.—(Syn., Zinc. Acet.; Fr. Acetas Zincicus, Acétate de Zinc; Ger. Zincum aceticum, Zinkacetat, Essigsaures Zinkoxyd.)

Manufacture: Dissolve zinc oxide (or carbonate) in hot, moderately diluted acetic acid, then filter, evaporate, crystallize—$ZnO + 2HC_2H_3O_2 = Zn(C_2H_3O_2)_2 + H_2O$. It is in soft, white, 6-sided, monoclinic plates, pearly lustre, faintly acetous odor, and (in dilute solutions) astringent, metallic taste, on exposure gradually effloresces losing some acid, soluble in water (2.3), boiling water (1.6), alcohol (30), boiling alcohol (1); aqueous solution neutral, slightly acid; contains 83.16–87.32 p. c. of anhydrous zinc acetate, corresponding to 99.5 p. c. of crystallized salt; when heated partially fuses, losing water and acid; at higher temperature decomposes, evolving inflammable, empyreumatic vapors, with a residue chiefly of zinc oxide. *Tests:* 1. Aqueous solution (1 in 20) with potassium ferrocyanide T. S.—white, gelatinous precipitate; with ammonium sulphide T. S.—white precipitate. 2. Add .1 Gm. to sulphuric acid and alcohol, each 1 Ml. (Cc.), warm—ethyl acetate, recognized by odor; aqueous solution with ammonium carbonate T. S.—at first white precipitate, redissolved by excess of reagent. *Impurities:* Heavy metals, arsenic, etc. Should be kept in well-closed containers. Dose, gr. 1–3 (.06–.2 Gm.).

PROPERTIES AND USES.—Astringent, irritant, emetic; erysipelas, delirium, diarrhœa in typhoid, mostly externally in conjunctivitis, gonorrhœa ($\frac{1}{5}$–$\frac{1}{2}$ p. c.). The injection is prepared usually by adding zinc sulphate and lead acetate, each gr. 12 (.8 Gm.) to water ℥viij

(240 Ml. (Cc.)), which by double decomposition gives zinc acetate in solution and lead sulphate precipitated, this latter being most excellent for sheathing inflamed parts.

Zinci Phenolsulphonas. Zinc Phenolsulphonate, $Zn(C_6H_5O_4S)_2 + 8H_2O$.—(Syn., Zinc. Phenolsulph., Zinc Sulphocarbolate, Zinci Sulphocarbolas, Zinc Phenol-para-sulphonate; Fr. Zinc Phenolsulfonique; Ger. Phenolsulfosaures Zink.)

Manufacture: Heat for 6 hours equal weights of phenol and sulphuric acid, neutralize with barium carbonate, now double decompose this solution of barium phenolsulphonate with solution of zinc sulphate, evaporate, crystallize. It is in colorless, transparent, rhombic prisms, tabular crystals, granules, odorless, astringent, metallic taste, effloresces on exposure to air and light, becoming slightly pink; soluble in water (1.6), boiling water (.4), alcohol (1.8); aqueous solution (1 in 10) acid; heated to 125° C. (257° F.) loses all water of crystallization; at higher temperature chars, emitting inflammable vapors with odor of phenol, and an incombustible residue; contains 73.7–77.4 p. c. of anhydrous zinc phenolsulphonate, corresponding to 99.5 p. c. of the crystallized salt. *Tests:* 1. Aqueous solution (1 in 20) with potassium ferrocyanide T. S.—white, gelatinous precipitate; with ammonium sulphide T. S. —white precipitate; with ammonium carbonate T. S.—white precipitate, redissolved in excess of reagent. 2. Aqueous solution (1 in 100) with ferric chloride T. S.—pale violet color. *Impurities:* Heavy metals, arsenic, sulphate. Should be kept in small, well-closed containers. Dose, gr. 1–3 (.06–.2 Gm.).

PROPERTIES AND USES.—Chiefly as a substitute for phenol (carbolic acid)—externally; antiseptic, astringent, stimulant for foul ulcers, mucous membrane inflammations, to prevent septicæmia in surgical operations (1–5 p. c. solution); gonorrhœa, leucorrhœa, etc. (injection, 1–5 in 1000).

Zinci Stearas. Zinc Stearate.—(Syn., Zinc. Stear.; Fr. Stéarate de Zinc, Zinc Stéarate; Ger. Zinkstearat.)

Manufacture: By mutual decomposition between zinc acetate (100) or sulphate (131) and sodium stearate (279), both salts being dissolved previously in boiling water, wash precipitate with hot water, dry, pulverize. It is a fine, white, bulky powder, tasteless, faint, characteristic odor, insoluble in water, alcohol, ether; neutral; when heated fuses; at higher temperature decomposes, emitting inflammable vapors with odor of burning fat, with a residue chiefly of zinc oxide; contains a small variable amount of palmitic acid, and zinc corresponding to 13–15.5 p. c. of zinc oxide. *Tests:* 1. Heat 1 Gm. with a mixture of distilled water 25 Ml. (Cc.) and hydrochloric acid 5 Ml. (Cc.)—stearic acid liberated, floating on surface as an oily layer. *Impurities:* Alkalies, alkali earths.

PREPARATION.—(Unoff.): *Unguentum Zinci Stearatis,* official 1900–1910—50 p. c., + white petrolatum 50.

Properties and Uses.—Antiseptic, astringent; gonorrhœa, atrophic rhinitis; apply in substance or combined with iodol, iodoformogen, or europhen (25 p. c.).

Allied Salts:

1. *Zinci Bromidum. Zinc Bromide,* $ZnBr_2$, official 1880–1910.—Obtained by digesting granulated zinc in hydrobromic acid, evaporating, drying—$Zn + 2HBr = ZnBr_2 + H_2$; or digest zinc, bromine, and water together, evaporate. It is a white granular powder, odorless, taste sharp, saline, metallic, very deliquescent, soluble in water, alcohol; contains, when anhydrous, 97 p. c. of pure salt. *Impurities:* Lead, copper, cadmium, arsenic, chloride, iodide, sulphate. Antispasmodic, hypnotic, nervine, tonic, irritant poison; epilepsy. Should be kept in small, glass-stoppered bottles. Dose, gr. 1–3 (.06–.2 Gm.).

2. *Zinci Iodidum. Zinc Iodide,* ZnI, official 1880–1910.—Obtained by dissolving zinc oxide, carbonate, or metal, in hydriodic acid; or digest metal with iodine and water, evaporate to dryness—(1) $Zn + 2HI = ZnI_2 + H_2$. (2) $Zn + I_2 + H_2O = ZnI_2 + H_2O$. It is a white granular powder, odorless, sharp, saline, metallic taste, very deliquescent, on exposure turning brown from liberated iodine, soluble in water, alcohol, ether, heated leaves residue of zinc oxide; contains when anhydrous, 98 p. c. of pure salt. Alterative, astringent, caustic; chorea, scrofula, hysteria. Externally—similar to chloride in enlarged tonsils, tumors, gonorrhœa, leucorrhœa; applied as ointment 10 p. c., or solution 2–5 p. c., or injection $\frac{1}{5}$–$\frac{1}{2}$ p. c. *Impurities:* Lead, copper, cadmium, arsenic, chloride, sulphate. Should be kept dark, in small, glass-stoppered bottles. Dose, gr. 1–3 (.06–.2 Gm.), in solution or syrup.

3. *Zinci Carbonas Impurus, Lapis Calaminaris. Calamine,* official 1830–1860. *Calamina Præparata*—calcined zinc carbonate; Unguentum Calaminæ, 17 p. c., + ointment 83.

4. *Zinci Oxidum Impurum. Tutty, Tuttia,* official 1830–1840.

5. *Zinci Phosphidum. Zinc Phosphide,* Zn_3P_2, official 1880–1900. —Obtained by fusing zinc and phosphorus; or pass phosphorus vapors in a current of dry hydrogen over fused zinc—$3Zn + 2P + \text{heat} = Zn_3P_2$. It contains 25 p. c. of phosphorus, and is a gritty, dark gray powder, or in crystalline fragments of dark metallic lustre, faint odor, phosphorus taste, insoluble in water, alcohol, soluble in diluted acids. Nervous stimulant, aphrodisiac, similar to phosphorus; defective nutrition of brain and spine, locomotor ataxia, paralysis, chlorosis, anæmia, amenorrhœa, etc. Should be kept in small, glass-stoppered vials. Dose, gr. $\frac{1}{16}$–$\frac{1}{3}$ (.004–.02 Gm.), in pill, powder, syrup, on empty stomach.

CADMIUM.

$Cd^{ii} = 111.5.$

The element cadmium (Gr. καδμεία, calamine, $ZnCO_3$—the two carbonates resemble and often occur together), official 1860–1880, is found sparingly in nature, associated with zinc ores, especially calamine—zinc carbonate. It is a white metal resembling tin, but heavier and more tenacious, crackles when bent, sp. gr. 8.7. The air has little effect upon it, but when heated it combines with 1 atom of oxygen, producing orange-red oxide, CdO; it combines with chlorine, bromine, iodine, and sulphur.

Tests for Cadmium Salts: 1. With H_2S or ammonium sulphide get yellow-orange sulphide. 2. NaOH or KOH produces white precipitate, insoluble in excess, while that of ammonia water is soluble in excess. 3. Sodium or potassium carbonates precipitate white cadmium carbonate; the salts of cadmium are little used in medicine, the sulphide to a considerable extent as a pigment.

PLUMBUM. LEAD.

$Pb^{ii} = 207.10.$

(Syn., Fr. Plomb; Ger. Blei.)

The element lead (AS. *lead*, heavy weight, plummet, L. *plumbum*), official 1820–1830, is obtained mostly from native sulphide (galena), PbS, by roasting in a reverberatory furnace: (1) $PbS + O_3 = PbO + SO_2$. (2) $PbS + O_4 = PbSO_4$. (3) $PbS + 2PbO = 3Pb + SO_2$. (4) $PbS + PbSO_4 = 2Pb + 2SO_2$; or heat sulphide with iron—$PbS + Fe = FeS + Pb$. Lead is a soft, fusible, heavy metal, sp. gr. 11.45, entering into the alloys of solder, shot, Britannia metal, type-metal, etc.

Tests for Lead Salts: 1. H_2S or NH_4SH precipitates insoluble black sulphide. 2. H_2SO_4, or soluble sulphate, precipitates white lead sulphate, insoluble in HNO_3. 3. Alkaline carbonates precipitate white basic lead carbonate insoluble in excess.

Plumbi Oxidum. Lead Oxide, PbO.—(Syn., Plumb. Oxid., Litharge, Oxide (Flowers) of Lead, Semi-vitrified Lead Oxide, Plumbum Oxydatum, Plumbi Oxidum Semi-vitreum; Fr. Oxyde de Plomb fondu, Protoxyde de Plomb; Ger. Lithargyrum, Bleiglätte, Bleioxyd.)

Manufacture: Heat metallic lead to whiteness (400–450° C.; 752–842° F.) in the air, the oxygen of which combines with the lead, forming lead oxide, while any silver present remains unchanged; if heated only to fusion, get yellow amorphous *massicot*, a less oxidized form. It is a heavy, reddish-yellow powder, or in minute scales, odorless, tasteless, on exposure absorbs moisture and CO_2, insoluble in alcohol, nearly so in water, soluble in acetic acid, diluted HNO_3, or warm solutions of fixed alkali hydroxides; heated with charcoal yields the metal; contains, when freshly ignited, 96 p. c. of the pure salt. *Tests:* 1. Solution in diluted nitric acid (1 in 10) is colorless, when nearly neutralized by ammonia water, + hydrogen sulphide T. S.—black precipitate, + potassium iodide T. S.—yellow precipitate, + diluted sulphuric acid—white precipitate. *Impurities:* Carbonate, moisture. Should be kept in well-closed containers.

PREPARATION.—1. *Liquor Plumbi Subacetatis*, 11 p. c.

Properties and Uses.—Chiefly externally and in combination, for burns, abraded surfaces, to allay inflammations; also enters into paints, flint glass, glazing of pottery, etc.; with KOH as caustic in condylomata, warts of glans penis and vagina, producing a superficial black slough. The emplastrum to prevent bed-sores, abrasions; if surface be large, plaster usually is substituted to avoid poisoning.

Plumbi Acetas. Lead Acetate, $Pb(C_2H_3O_2)_2 + 3H_2O$.—(Syn., Plumb. Acet., Sugar of Lead, Acetas Plumbicus, Saccharum Saturni, Cerussa Acetata; Fr. Acétate — Sucre de Plomb, Sucre—Sel de Saturne; Ger. Plumbum aceticum, Bleiacetat, Essigsaures Bleioxyd, Bleizucker.)

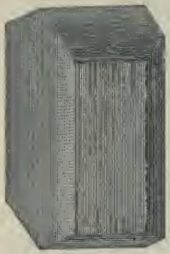


Fig. 461 — Lead acetate crystal.

Manufacture: Act upon lead oxide (1) with 30 p. c. acetic acid (2), evaporate, crystallize—$PbO + 2HC_2H_3O_2 + \text{heat} = Pb(C_2H_3O_2)_2 + H_2O$; or expose lead plates to the combined action of air and vinegar. It is in colorless, shining, transparent, monoclinic prisms or plates, or heavy, white, crystalline masses, granular crystals, faintly acetous odor, sweetish, astringent, metallic taste, efflorescent, absorbing carbon dioxide, soluble in glycerin, water (1.4), boiling water (.5), alcohol (38); at 40° C. (104° F.) loses water of crystallization, at 75° C. (167° F.) fuses in its water of crystallization, at 280° C. (536° F.) decomposes into lead mixed with lead oxide; contains 85.31–89.57 p. c. of anhydrous lead acetate, corresponding to 99.5 p. c. of crystallized salt. *Impurities:* Iron, copper, carbonate. Should be kept in well-closed containers. Dose, gr. $\frac{1}{2}$–4 (.03–.26 Gm.), usually with opium.

Preparations.—1. *Liquor Plumbi Subacetatis.* Solution of Lead Subacetate. (Syn., Liq. Plumb. Subacet., Goulard's Extract, Acetum Plumbicum (Saturni), Plumbum Hydrico-aceticum Solutum; Br. Liquor Plumbi Subacetatis Fortis; Fr. Sous-acétate de Plomb liquide, Extrait de Saturne (de Goulard), Vinaigre de Plomb (de Saturne); Ger. Liquor Plumbi subacetici, Bleiessig.)

Manufacture: Dissolve lead acetate 18 Gm. in boiling distilled water 70 Ml. (Cc.), add it slowly, in portions, to lead oxide 11 Gm., previously rubbed to smooth paste with distilled water 10 Ml. (Cc.); boil half an hour, stirring occasionally, preserving volume by adding a little distilled water, cool, filter, add boiled, cooled distilled water q. s. 100 Gm. It is a clear, colorless, aqueous liquid, odorless, very sweet, astringent taste, alkaline to litmus but not to phenolphthalein, on exposure absorbs carbon dioxide causing white precipitate, sp. gr. 1.245; contains lead subacetate corresponding to 18 p. c. of lead. *Tests:* 1. Aqueous dilution (1 in 10), using recently boiled distilled water, with (*a*) hydrogen sulphide—black precipitate, (*b*) potassium iodide T. S.—yellow precipitate, (*c*) diluted sulphuric acid—white precipitate. *Impurities:* Iron, copper, normal lead acetate. Should be kept in well-stoppered bottles.

Preps.: 1. *Liquor Plumbi Subacetatis Dilutus.* Diluted Solution of Lead Subacetate. (Syn., Liq. Plumb. Subacet. Dil., Lead Water, Goulard's Lotion (Water), Aqua Plumbica (Saturnina); Fr. Eau de Saturne, Eau blanche; Ger. Aqua Plumbi, Bleiwasser, Kühlwasser.)

Manufacture: Mix solution of lead subacetate 4 Gm. with distilled water, previously boiled and cooled, q. s. 100 Gm. It is an aqueous liquid containing 1 p. c. of lead subacetate. Should be kept in small, well-filled, tightly-stoppered bottles.

2. *Emplastrum Plumbi.* Lead Plaster. (Syn., Emp. Plumb., Diachylon Plaster, Litharge Plaster, Emplastrum Diachylon Simplex, Emplastrum Album Coctum; Fr. Emplastrum Simplex, Emplâtre simple (de Plomb—de Litharge); Ger. Emplastrum Lithargyri (Simplex), Bleipflaster, Emplastrum Cerussæ, Bleiweisspflaster.)

Manufacture: Heat olive oil 100 Gm. + lard 100 Gm. until liquefied, sift lead oxide 100 Gm., through (80) sieve, upon surface of hot liquid, mix thoroughly, add gradually boiling water 35 Ml. (Cc.), boil, constantly stirring and adding water occasionally, until mass homogeneous and a portion is pliable and tenacious in cold water; remove from fire and wash out glycerin with warm water (several times), free from water by kneading, roll into suitable size cylinders, and wrap in paper.

Preps.: 1. *Unguentum Diachylon.* Diachylon Ointment. (Syn., Ung. Diachyl., Unguentum Plumbi Hebræ, Hebra's Lead Ointment; Fr. Onguent (Pommade de) Diachylon; Ger. Bleipflastersalbe, Diachylonsalbe.)

Manufacture: Melt together lead plaster 50 Gm., white petrolatum 49 Gm., with gentle heat, strain, cool, but not congeal, add oil of lavender 1 Gm., stir until cold.

2. *Emplastrum Resinæ,* 80 p. c.

Unoff. Preps.: Ceratum Plumbi Subacetatis, Goulard's Cerate: solution of lead subacetate 20 Gm., melted wool fat 20 Gm., white petrolatum 38 Gm., white wax 20 Gm., camphor 2 Gm. *Lotio Plumbi et Opii,* 1.75 p. c., tinct. opium 3.5, water q. s. 100. *Mistura Astringens:* solution of lead subacetate 10 p. c., + copper sulphate 6.5, zinc sulphate 6.5, dil. acetic acid 85. *Unguentum Plumbi Subacetatis* (Br.); strong solution of lead subacetate 12.5 p. c. *Glycerinum Plumbi Subacetatis* (Br.); strong solution of lead subacetate 50 p. c. *Pilula Plumbi cum Opio* (Br.); lead acetate (80), opium (12), syrup of glucose (8), dose, gr. 2–4 (.13–.26 Gm.). *Suppositoria Plumbi Composita* (Br.); each contains lead acetate 3 gr. (.2 Gm.), + opium 1 gr. (.06 Gm.).

Properties and Uses.—Astringent, sedative, large doses irritant poison, diarrhœa, dysentery, internal hemorrhage, aneurism, tympanites, epilepsy, neuralgia, chorea, hysteria, bronchitis, whooping-cough, sweats. Externally—contusion, excoriations, fractures, sprains, gonorrhœa, leucorrhœa, chronic eczema, eye affections (conjunctivitis, etc.; wash or drops, $\frac{1}{5}$–$\frac{1}{2}$ p. c. in distilled water). Cerate—for excoriations, burns, scalds, chilblains, skin eruptions, acute inflammations.

Poisoning: From any of the lead salts, when acute have burning, sweetish taste, thirst, vomiting (whitish fluid, due to lead chloride), abdominal colic (relieved by pressure), abdominal muscles rigid, cramps in legs, paralysis of extremities, rapid, weak pulse, livid face, stupor, constipation, feces black (lead sulphide), cold skin, collapse, giddiness, coma, convulsions, death. Give magnesium or sodium sulphate, then induce vomiting, follow with purgative enema, demulcent drinks, egg-white, milk, stimulants, opium; for lead colic hot fomentation, opiates, evacuants; for chronic lead-poisoning (constipation and dark blue line along margin of gums, wrist-drop) give iodides to saturation (Na, K, Ca), sulphurous baths, calomel, sulphuric acid, lemonade, friction to muscles, electricity, strychnine.

Allied Salts:

1. *Plumbi Oxidum Rubrum. Red Oxide of Lead. Red Lead,* Pb_3O_4—$2PbO,PbO_2$, official 1840–1850.—Obtained by heating massicot to 450° C. (840° F.), which gradually combines with more oxygen, forming red lead. It is a bright reddish-orange, granular, crystalline powder, becoming redder by more heat, then purple, finally black. At red heat gives up oxygen, becoming litharge; sp. gr. 8.7–9.1, this lead orthoplumbate corresponds to 31 p. c. of lead dioxide; Emplastrum Fuscum Camphoratum, 30 Gm., + olive oil 60, yellow wax 15, camphor 1, Unguentum Fuscum, 50 p. c., olive oil 25, prepared suet 25.

2. *Plumbi Carbonas. Lead Carbonate,* $(PbCO_3)_2,Pb(OH)_2$, official 1840–1900.—Obtained by exposing lead sheets to air, acetic acid vapors, and carbon dioxide—$6Pb + 6HC_2H_3O_2 + O_6 + 2CO_2 = (PbCO_3)_2,Pb(OH)_2 + 2H_2O + 3Pb(C_2H_3O_2)_2$, or by double decomposition between lead nitrate and sodium carbonate. It is a heavy white opaque powder or pulverulent mass, odorless, tasteless, permanent, insoluble in water, alcohol, soluble in acetic acid or diluted HNO_3 with effervescence. Used externally as a protective to irritated surfaces, also to constringe; erysipelas, erythema, intertrigo, ulcers, excoriated surfaces, eczema, burns, carbuncles; as paint, cosmetic; often produces chronic poisoning when applied to abraded parts; usually applied in fine powder or ointment (10 p. c.).

3. *Plumbi Nitras. Lead Nitrate,* $Pb(NO_3)_2$, official 1840–1910.—Obtained by neutralizing warm dilute nitric acid with lead oxide or carbonate, crystallizing in a cool place—$PbO + 2HNO_3 = Pb(NO_3)_2 + H_2O$. It is in colorless, transparent or opaque octahedral crystals, odorless, sweetish, astringent, metallic taste, permanent, soluble in water (1.85), insoluble in alcohol (thus differing from acetate), chars into oxide; contains 99.5 p. c. of pure salt. *Impurities:* Iron, copper, zinc, salts of alkalies, magnesium, calcium, etc. Discutient, deodorizer —externally; to correct fetor of gangrenous sores, discharges from ear, nostril (ozæna), rectum, vagina; sore nipples, chapped hands, cracked lips, leucorrhœa, gonorrhœa, ulcers, impetigo, epithelioma; Ledoyen's disinfecting fluid (12.p. c.) valuable deodorant. Dose, gr. $\frac{1}{2}$–4 (.03–.26 Gm.).

4. *Plumbi Iodidum. Lead Iodide,* PbI_2, official 1850–1910.—Obtained by mixing equal quantities (120 Gm.) of lead nitrate and potassium iodide, each dissolved separately in sufficient water (500 Ml. (Cc.)), filtering, washing, drying precipitate—$Pb(NO_3)_2 + 2KI = PbI_2 + 2KNO_3$. It is a heavy, bright yellow powder, odorless, tasteless, permanent, soluble in fixed alkali solutions, water (1300), boiling water (200), decomposed by heat; contains 99 p. c. of pure salt. *Impurities:* Nitrate, acetate, chromate, soluble and insoluble foreign salts. Resolvent, alterative; tuberculous diseases, scrofulous tumors, ulcers, indolent swellings, malarial enlargement of spleen; ointment, 10 p. c., best form externally. Should be kept dark, in well-stoppered bottles. Dose, gr. ½–4 (.03–.26 Gm.), ter die, in pill; ointment, 10 p. c., benzoinated lard 90.

CUPRUM. COPPER.

$Cu^{ii} = 63.5.$

The element copper (Gr. κύπρος, Cyprus, Mediterranean island, whence the Romans got their best copper; L. *cuper, cuprum,* contr. of Cyprium), official 1870–1880, enters into alloys—brass, German silver, bell-metal, bronze, gun-metal, gold, silver, and occurs in nature as metal, sulphide, oxide, sulphate, carbonate, phosphate, and arsenate. The most common ore—copper pyrites, Cu_2S,Fe_2S_3, has brass or gold lustre, but copper glance, Cu_2S (dark gray), and malachite, $CuCO_3,$-$Cu(OH)_2$ (beautiful green), yield considerable metal. Copper is red in color, malleable, sp. gr. 8.92–8.95, good conductor of heat and electricity, by exposure becoming coated with green film of subcarbonate; forms two oxides: 1. Red—*cuprous,* Cu_2O; 2. Black—*cupric,* CuO.

Tests for Copper Salts: 1. H_2S or NH_4SH precipitates black cupric sulphide. 2. KOH or $NaOH$ precipitates blue cupric hydroxide, $Cu(OH)_2$, which by boiling becomes dark brown cupric oxide, CuO; but with NH_4OH get only dark blue solution—an ammonio-copper compound. 3. Potassium ferrocyanide precipitates reddish-brown cupric ferrocyanide, $Cu_2Fe(CN)_6$. 4. Polished iron, steel, or zinc immersed in an acidified copper solution becomes coated with metallic copper.

Cupri Sulphas. Copper Sulphate, $CuSO_4 + 5H_2O$.—(Syn., Cupr. Sulph., Cupric Sulphate, Blue Vitriol, Blue-stone, Roman Vitriol, Cuprum Vitriolatum, Sulfas Cupricus; Fr. Sulfate de Cuivre, Vitriol bleu, Couperouse bleu; Ger. Cuprum sulfuricum, Kupfer-(vitriol)-sulfat, Blauer (vitriol) Galitzenstein, Schwefelsaures Kupfer.)

Manufacture: Heat copper with sulphuric acid, shake with hot water, evaporate, crystallize—$Cu + 2H_2SO_4 = CuSO_4 + 2H_2O + SO_2$, or may heat copper pyrites. It is in deep blue, triclinic crystals, blue granular powder, odorless, nauseous, metallic taste, slowly efflorescent, soluble in water (2.5), boiling water (.5), alcohol (500), glycerin (2.8); aqueous solution blue, acid; contains 62.97–66.79 p. c.

of anhydrous copper sulphate, corresponding to 98.5 p. c. of the crystallized salt. *Tests:* 1. Heat to 30° C. (86° F.) loses part of water of crystallization, becoming a pale blue, amorphous powder; at 100° C. (212° F.) loses more water, at 200° C. (392° F.) a white amorphous powder remains, and at higher heat sulphur dioxide and oxygen are given off, leaving a residue of black cupric oxide. 2. Aqueous solution 1 drop on bright iron—red film deposits (metallic copper). 3. Aqueous solution, + barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. *Impurities:* Other metals. Should be kept in well-closed containers. Dose, tonic, astringent, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.), in pill; emetic, gr. 2–10 (.13–.6 Gm.), mixed with sugar or in solution, repeated in 15 minutes if necessary.

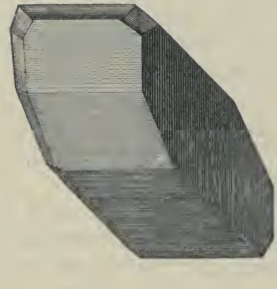


FIG. 462.—Copper sulphate crystal.

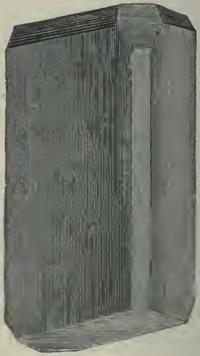


FIG. 463.—Copper acetate crystal.

PROPERTIES AND USES.—Astringent, tonic, irritant, escharotic, emetic, stimulant. Once used for epilepsy, and now for chronic ulcerative diarrhœa, dysentery, cholera, croup, malignant sore throat. Externally—foul ulcers, caustic for warts, fungoids, callous, bleeding surfaces, chancres, ulcerative stomatitis, gangrene of pharynx, mercurial sore mouth, conjunctivitis, acne, eczema. Convenient forms for application are the crystal, cuprum aluminatum (*lapis divinus, pierre divine, pierre ophthalmique,* in pencils or stick), and the wash ($\frac{1}{2}$–1–2 p. c.). Used also as a test for diabetic sugar, and in making many green pigments, as Scheele's green (arsenite), Paris green (aceto-arsenite), Bremen green (hydroxide), and others.

Poisoning: Large doses gastro-intestinal irritant; long-continued small doses cause bronchial catarrh, colic, vomiting, diarrhœa (bloody, mucous), tenesmus, salivation, anæmia, wasting, jaundice, fatty liver, nervousness, thirst, hurried respiration, delirium, small, rapid pulse, convulsions, coma. Give egg-white to form insoluble compound, then emetics at once, also reduced iron, weak solution potassium ferrocyanide (chemical antidote), magnesium oxide, tannin, opium, again empty stomach and saturate system with potassium iodide, heat, stimulants.

Incompatibles: Alkalies, their carbonates, sulphides, mineral salts (except sulphates), lime water, iodides, vegetable astringents.

Allied Salts:

1. *Cupri Acetas. Copper Acetate,* $Cu(C_2H_3O_2)_2.H_2O$, official 1880–1890.—Obtained by dissolving verdigris in acetic acid, or precipitate solution of lead acetate with copper sulphate. It is in deep bluish-green rhombic prismatic crystals, efflorescent, odorless, nauseating metallic taste, soluble in water (15), alcohol (135). *Impurities:* Alkalies, alkaline earths, iron, lead, zinc, chloride, sulphate, calcium. Dose, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.). Solutions should be $\frac{1}{5}$–1 p. c.

PROPERTIES AND USES.—Skin diseases, scrofula, intermittents, epilepsy, in collyria, aphthous ulcers, gonorrhœa.

2. *Cupri Subacetas. Copper Subacetate. Verdigris,* $Cu_2O(C_2H_3O_2)_2$, official 1830–1880.—Obtained by subjecting grape husks to acetic fermentation, then stratifying them in earthen vessels with sheets of copper for 4–6 weeks, when the sheets upon drying and exposing to air for several weeks are coated with verdigris, which is scraped off and the plates replaced for a second action, etc.; the verdigris is dried in the sun, and occurs in masses, having bluish-green color, composed of many silky crystals, coppery taste, insoluble in alcohol, soluble in ammonia, HCl, diluted H_2SO_4, partially in water.

PROPERTIES AND USES.—Stimulant, escharotic; externally—indolent ulcers, tuberculated skin affections, warts, chancres. Not used internally.

3. *Cuprum Ammoniatum. Ammoniated Copper,* $Cu(NH_3)_4SO_4,H_2O$.—Obtained by rubbing together copper sulphate 4, ammonium carbonate 3, until effervescence ceases, drying. Deep azure-blue color, ammoniacal odor. Epilepsy, chorea. Dose, gr. $\frac{1}{2}$–1 (.03–.06 Gm.). *Copper Arsenite* (Scheele's green) may be employed in cholera infantum, diarrhœa.

BISMUTHUM. BISMUTH.

$Bi^{iii} = 208$

The element bismuth (Ger. *wismut,* fr. *wiesematte,* a beautiful shadow, from its variegated tints when fresh), official 1830–1880, is found mostly in metallic state as small veins in rocks, occurs also as sulphide; it is obtained from the ore by heating until sufficiently mobile to separate from its earthy matter. Bismuth is brittle, crystalline, brilliant, with silver color and pinkish tinge, forms several alloys and many medicinal salts, some being official.

Tests for Bismuth Salts.—1. H_2S or NH_4SH precipitates black bismuth sulphide, Bi_2S_3, insoluble in excess. 2. Acid bismuth solutions poured into water form white precipitate of subsalts or bismuthyl salts. 3. Ammonium or sodium hydroxide or carbonate precipitates white bismuth hydroxide, $Bi(OH)_3$, or bismuthyl carbonate.

Bismuthi Subnitras. Bismuth Subnitrate, $BiONO_3H_2O$ (?).—(Syn., Bism. Subnit., White Bismuth, Bismuthum Hydrico-nitricum, Magisterium Bismuthi, Subazotas (Subnitras) Bismuthicus, Bismuthyl

Nitrate; Br. Bismuth Oxynitrate; Fr. Sous-azotate (Sous-nitrate) de Bismuth; Ger. Bismutum subnitricum, Basisches Wismutnitrate (Salpetersaures Wismutoxyd), Wismutsubnitrat.)

Manufacture: Dissolve purified bismuth (1) in nitric acid (5), heated to 90° C. (194° F.), let stand several days, decant, evaporate to crystallization; rub uniformly crystals (1) with water (4) and pour while stirring into boiling water (21), drain, wash, dry—$Bi_2 + 8HNO_3 = 2Bi(NO_3)_3 + 2NO + 4H_2O$; $6Bi(NO_3)_3 + 10H_2O = 5BiONO_3,H_2O + Bi(NO_3)_3 + 10HNO_3$. It is a white powder, odorless, almost tasteless, slightly hygroscopic, almost insoluble in water, insoluble in alcohol, readily soluble in hydrochloric or nitric acid, slightly acid; composition somewhat varying; contains, upon ignition, 79 p. c. of bismuth oxide. *Tests:* 1. Dissolve in slight excess of warm nitric or hydrochloric acid and add to 25 volumes of distilled water—white turbidity. 2. Heat to redness—evolves nitrous vapors, leaving yellow residue blackened by hydrogen sulphide T. S. *Impurities:* Arsenic, copper, lead, silver, alkalies, alkali earths, carbonate, chloride, sulphate, insoluble foreign salts. Dose, gr. 5–30 (.3–2 Gm.), ter die, in water on empty stomach.

Properties and Uses.—Sedative, astringent, almost insoluble in the system, acts mechanically by coating the gastric mucous membrane with a protective film, thus preventing irritation from contents. Used in diseases of the stomach—gastralgia, subacute gastritis, pyrosis, irritated intestinal mucous membrane, diarrhœa, dysentery, cholera infantum; injection in gonorrhœa, leucorrhœa, dysentery, rectal irritation, coryza; the powder locally in burns, variola, eczema, fissures chapped nipples, lips, hands, intertrigo, ozæna, fetid feet, whooping-cough; also a test for diabetic sugar.

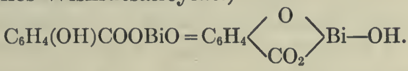
Preparations.—(Unoff.): *Glyceritum Bismuthi,* 16 Gm., nitric acid 15, tartaric acid 23.8, sodium bicarbonate 33.4, glycerin 47.5, water q. s. *Elixir Bismuthi*—glycerite of bismuth 12.5, glycerin 12.5, dist. water 25, aromatic elixir q. s. 100. *Liquor Bismuthi*—glycerite of bismuth 12.5, alcohol 12.5, dist. water q. s. 100.

Bismuthi Subcarbonas. Bismuth Subcarbonate, $(BiO)_2CO_3,H_2O$(?).—(Syn., Bism. Subcarb., Pearl White, Bismuthum Subcarbonicum, Subcarbonas Bismuthicus, Bismuthyl Carbonate; Br. Bismuthi Carbonas, Bismuth Oxycarbonate; Fr. Sous-carbonate de Bismuth; Ger. Basisches Kohlensaures Wismutoxyd, Wismutsubcarbonat.)

Manufacture: Dissolve purified bismuth in nitric acid diluted, filter, add ammonia water, wash and dissolve precipitate in nitric acid, pour this into cold solution of sodium carbonate, constantly stirring, filter, wash and dry precipitate. (1) $Bi + 4HNO_3 = Bi(NO_3)_3 + NO + 2H_2O$. (2) $2Bi(NO_3)_3 + 3Na_2CO_3 + H_2O = (BiO)_2CO_3,H_2O + 6NaNO_3 + 2CO_2$. It is a white, pale yellowish-white powder, odorless, tasteless, permanent, insoluble in water, alcohol, completely soluble in nitric or hydrochloric acid with copious effervescence; composition somewhat varying; contains, upon ignition, 90 p. c. of bismuth oxide. *Tests:* 1. Dissolve in slight excess of nitric acid and add to 25 volumes of distilled water—white turbidity. 2. Heat to redness—loses water and carbon dioxide, leaving yellowish residue soluble in nitric or hydrochloric acid and blackened by hydrogen sulphide T. S. *Impurities:* Arsenic, copper, lead, silver, alkalies, alkali earths, chloride, nitrate, sulphate. Dose, gr. 5–30 (.3–2 Gm.).

Properties and Uses.—Intended as a substitute for subnitrate, as it is a little more soluble, hence less likely to constipate and blacken the stools; but as these are disadvantages, it is not much used.

Bismuthi Subsalicylas. Bismuth Subsalicylate.—(Syn., Bism. Subsalicyl.; Br. Bismuthi Salicylas, Bismuth Oxysalicylate, Basic Bismuth Salicylate; Fr. Sous-salicylate de Bismuth; Ger. Bismutum subsalicylicum, Basisches Wismutsalicylat.)

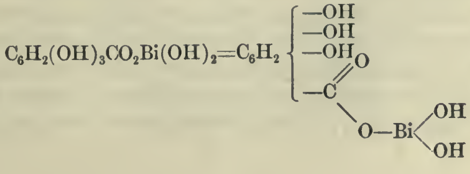


$$C_6H_4(OH)COOBiO = C_6H_4\left\langle\begin{matrix}O\\CO_2\end{matrix}\right\rangle Bi—OH.$$

Manufacture: Digest for 2 days in a warm place, frequently stirring, bismuth subnitrate (500), distilled water (1000), add strong ammonia water (50), wash precipitate (Bi_2O_3), and while moist add a little distilled water and salicylic acid (125), let stand 24 hours, frequently stirring, wash precipitate, dry. It is a white, nearly white, amorphous or crystalline powder, odorless, tasteless, permanent, almost insoluble in water but when boiled in it a portion of the salicylic acid is dissolved with the formation of a more basic bismuth subsalicylate; partly soluble, with decomposition, in hydrochloric or nitric acid—white flocculent precipitate of salicylic acid separating; composition somewhat varying; contains, upon ignition, 62–66 p. c. of bismuth oxide. *Tests:* 1. Heat to redness—chars, residue yellow, blackened by hydrogen sulphide, which dissolved in slight excess of warm nitric or hydrochloric acid and added to 25 volumes of distilled water—white turbidity. 2. Agitate .1 Gm. with a solution of 5 drops of ferric chloride T. S. in 10 Ml. (Cc.) of distilled water—deep violet-blue. *Impurities:* Arsenic, copper, lead, silver, alkali earths, chloride, nitrate, sulphate, free salicylic acid. Should be kept dark. Dose, gr. 5–15 (.3–1 Gm.).

Properties and Uses.—Internal antiseptic, astringent; passes through stomach unchanged, but is decomposed in small intestine, where it acts as an unirritating antiseptic. Diarrhœa, typhoid, catarrh of alimentary tract, mucous membrane inflammation, gastric disorders; externally like iodoform—wounds, etc.

Bismuthi Subgallas. Bismuth Subgallate.—(Syn., Bism. Subgal., Dermatol, Bismuthyl Gallate; Fr. Sous-gallate de Bismuth; Ger. Bismutum subgallicum, Basisches Wismutgallat, Wismutsubgallat.)



Manufacture: Dissolve bismuth trinitrate (15) in glacial acetic acid (30), add water (250), to filtrate, constantly stirring, add warm aqueous solution of gallic acid (5 in 250), wash precipitate by decantation until free from nitric acid, dry. It is an amorphous, bright yellow powder, odorless, tasteless, permanent, insoluble in water, alcohol, ether, readily soluble with decomposition in warm hydrochloric, nitric, or sulphuric acid, soluble in alkali hydroxide solutions—clear, yellowish, rapidly changing to deep red; composition somewhat varying; contains, upon ignition, 52–57 p. c. of bismuth oxide. *Tests:* 1. Heat to redness—chars, residue yellow, blackened by hydrogen sulphide T. S., which dissolved in slight excess of warm nitric or hydrochloric acid and added to 25 volumes of distilled water—white turbidity. 2. Agitate .1 Gm. with excess of hydrogen sulphide T. S.—brownish-black precipitate, boil filtrate to remove dissolved gas, cool, + a drop of ferric chloride T. S.—blue-black. *Impurities:* Arsenic, copper, lead, silver, alkalies, alkali earths, chloride, nitrate, sulphate, free gallic acid. Dose, gr. 5–30 (.3–2 Gm.).

PROPERTIES AND USES.—Antiseptic. Like iodoform, but has sedative, astringent, drying, and antibacterial effects upon wounds, ulcers, eczemas; fermentative dyspepsia, diarrhœa of tuberculosis and typhoid fever; apply in powder, ointment (1 + 10 vaseline), gauze (10 p. c.).

Incompatibles: Acids.

Magma Bismuthi. Bismuth Magma.—(Syn., Magma Bism., Milk of Bismuth; Fr. Lait de Bismuth; Ter. Wismutmilch.)

Manufacture: Mix in a flask bismuth subnitrate 8 Gm. with distilled water and nitric acid, each 6 Ml. (Cc.), agitate, warm gently until dissolved; pour solution, stirring constantly, into 500 Ml. (Cc.) of distilled water containing nitric acid 6 Ml. (Cc.); mix in glazed vessel ammonia water 48 Ml. (Cc.) with distilled water 400 Ml. (Cc.), dissolve in it ammonium carbonate 1 Gm., and into this pour the bismuth solution, stirring constantly; unless alkaline render so with ammonia water, let stand until precipitate subsides, pour or siphon off supernatant liquid, wash precipitate twice with distilled water, by decantation, wash magma, add distilled water q. s. 100 Ml. (Cc.); mix thoroughly. It is a thick, white, opaque liquid, containing bismuth hydroxide and bismuth subcarbonate in suspension in water, neutral; to 1 Ml. (Cc.) add hydrochloric acid 1 Ml. (Cc.)—clear solution, which poured into 10 volumes of distilled water—white precipitate; contains 5.6–6.2 p. c. of bismuth oxide, Bi_2O_3. Dose, ʒss–2 (2–8 Ml. (Cc.)).

Bismuthi Betanaphtholas. Bismuth Betanaphthol, $C_{10}H_7O.Bi_2O_2$-(OH).—(Syn., Bism. Betanaph., Bismuth Betanaphtholate, Orphol, Fr. β Naphthol de Bismuth; Ger. Bismutum (Wismut) beta-naphthol.)

Manufacture: Act upon bismuth trinitrate dissolved in dilute glycerin or acid with alkaline solution of betanaphthol. It is a buff, grayish-brown amorphous powder, odorless, faint odor of betanaphthol, tasteless, permanent, nearly insoluble in water, alcohol, chloroform, ether, partially in mineral acids forming corresponding bismuth salts and liberating betanaphthol; composition somewhat varying; should contain 15 p. c. of betanaphthol, and, upon ignition, 73–78 p. c. of bismuth oxide. *Tests:* 1. Heat strongly—chars, residue grayish-yellow, blackened by hydrogen sulphide T. S. 2. Shake 1 Gm. with chloroform (20 Ml. (Cc.)), evaporate filtrate spontaneously, dry in desiccator —residue 1 p. c. (abs. of free betanaphthol). *Impurities:* Free betanaphthol, arsenic, copper, lead, silver, chloride, nitrate, sulphate. Dose, gr. 5–8 (.3–.5 Gm.), 5–6 times daily; children gr. 1–5 (.06–.3 Gm.).

PROPERTIES AND USES.—Decomposed in the duodenum into naphthol and bismuth hydroxide, when each exerts its own effects. Intestinal astringent, antiseptic, substitute for iodoform—diarrhœa, dysentery, cholera infantum, gastro-intestinal catarrh (gastritis), enteritis, dyspepsia, ulcers, mucous inflammations, impetigo; should not be mixed with acacia which forms viscid preparations rapidly hardening.

Bismuthi et Ammonii Citras. Bismuth and Ammonium Citrate, $BiC_6H_5O_7,NH_4OH,2H_2O(?)$.—(Syn., Bism. et Ammon. Cit., Bismuth Ammonio-Citrate, Bismuthum Citricum Ammoniatum; Fr. Citrate de Bismuth (Ammoniacal) et d'Ammoniaque; Ger. Citronensaures Wismut (oxyd) ammonium.)

Manufacture: Rub to a paste bismuth citrate 100 Gm. with distilled water 200 Ml. (Cc.), heat gradually, add ammonia water until salt dissolved and liquid neutral, filter, evaporate to syrupy consistence, spread upon glass plates so as to dry in scales. It is in shining, pearly or translucent scales, odorless, metallic taste, opaque on exposure with loss of ammonia, soluble in water, sparingly in alcohol, fuses leaving blackened residue with yellow surface, which dissolved in nitric or hydrochloric acid produces a white turbidity when added to 25 volumes of distilled water; aqueous solution (1 in 20) neutral, faintly acid; contains, upon ignition, 46–52 p. c. of bismuth oxide. *Tests:* 1. Boil with slight excess of sodium hydroxide T. S.—evolves ammonia. 2. Aqueous solution + excess of hydrogen sulphide—black precipitate; filtrate deprived by heat of excess of hydrogen sulphide and boiled with excess of lime water—white precipitate. *Impurities:* Arsenic, copper, lead, silver, alkalies, alkali earths, chloride, nitrate, sulphate. Should be kept dark in well-closed containers. Dose, gr. 1–4 (.06–.26 Gm.), best in solution.

Unoff. Prep.: Liquor Bismuthi et Ammonii Citratis (Br.), 7 p. c., dose, ʒss–1 (2–4 Ml. (Cc.)).

PROPERTIES AND USES.—Differs from the insoluble bismuth salts in being more astringent and irritating; employed in chronic serous diarrhœa due to relaxed condition of the intestinal mucous membrane, but never where acute inflammation or irritation exists; not nearly so valuable as the insoluble salts.

Allied Salts:

1. *Bismuthi Citras. Bismuth Citrate,* $BiC_6H_5O_7$, official 1880–1910.—Obtained by heating on a water-bath bismuth subnitrate 100 Gm., citric acid 75 Gm., distilled water 400 Ml. (Cc.), frequently stirring, until a drop is clear in ammonia water, adding distilled water 5000 Ml. (Cc.), washing, drying precipitate—$(BiONO_3 + H_2O) + H_3C_6H_5O_7 + H_2O) = BiC_6H_5O_7 + HNO_3 + 3H_2O$. It is a white amorphous or crystalline powder, odorless, tasteless, permanent, insoluble in water, alcohol, soluble in ammonia water and alkaline citrate solutions; should yield 58–60 p. c. of pure bismuth oxide. Astringent, irritant, similar to subnitrate; important only as the base of the official bismuth and ammonium citrate. *Impurities:* Lead, copper, silver, arsenic, chlorides, sulphates, nitrate, etc. Dose, gr. 1–3 (.06–.2 Gm.).

1. *Bismuthi Oxidum. Bismuth Oxide,* Bi_2O_3.—Obtained by boiling 5 minutes bismuth subnitrate in solution of sodium hydroxide, filter dry precipitate—$2(BiONO_3,H_2O) + 2NaOH) = 2Bi(OH)_3$ or $(Bi_2O_3,3H_2O) + 2NaNO_3)$. Occurs as a dull lemon-yellow powder, resembling the subnitrate in medicinal properties, doses, and uses.

ARGENTUM. SILVER.

$Ag^i = 107.8.$

The element silver (AS. *seolfer;* L. *argentum;* Gr. ἄργυρος, white —*i. e.,* its bright, shining color), official 1830–1880, occurs natively as metal and sulphide; the latter, being along with lead sulphide—argentiferous galena—is simply roasted, when lead oxidizes into litharge and pure silver separates. Silver may also be obtained by amalgamation—dissolving it in mercury and distilling the amalgam, when mercury, being volatile, passes over, and silver remains. It is the whitest metal, best conductor of heat and electricity, takes brilliant polish, malleable, ductile, sp. gr. 10.4–10.5.

Tests for Silver Salts: 1. H_2S or NH_4SH precipitates black silver sulphide, Ag_2S. 2. Hydrochloric acid, or any soluble chloride, precipitates white curdy silver chloride, AgCl, insoluble in hot HNO_3, but soluble in ammonia water. 3. Alkaline hydroxides precipitate brown silver oxide, Ag_2O, soluble in ammonia water. 4. Metallic copper, zinc, or iron precipitates metallic silver.

Argenti Nitras. Silver Nitrate, $AgNO_3$.—(Syn., Arg. Nit., Lunar Caustic; Fr. Azotas (Nitras) Argenticus, Azotate (Nitrate) d'Argent, Nitre lunaire; Ger. Argentum nitricum (Crystallizatum), Silbernitrat, Salpetersaures Silberoxyd, Silbersalpeter.)

Manufacture: Dissolve silver in nitric acid by heat, evaporate to dryness to expel free acid, dissolve dry mass in hot water, crystallize —$3Ag + 4HNO_3 = 3AgNO_3 + NO + 2H_2O$. It is in colorless, transparent, tabular, rhombic crystals, gray or grayish-black on exposure to light in presence of organic matter, odorless, bitter, caustic, strongly metallic taste, soluble in water (.4), boiling water (.1), alcohol

(30), boiling alcohol (6.5), melts at 200° C. (392° F.) into yellowish liquid which on cooling congeals into pure white crystalline mass; aqueous solution clear, colorless, neutral; contains 99.8 p. c. of pure salt. *Tests:* 1. Aqueous solution + hydrochloric acid—white curdy precipitate, insoluble in nitric acid, readily soluble in ammonia water. 2. Aqueous solution (1 in 10) + a drop of diphenylamine T. S. onto which pour carefully sulphuric acid to form separate layer—deep blue at line of contact. *Impurities:* Copper, etc. Should be kept dark, in dark amber-colored vials. Dose, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.), ter die, in pill with bitter extracts, but not with bread containing salt, as this hastens decomposition; best given on empty stomach.

PREPARATION.—1. *Argenti Nitras Fusus.* Molded Silver Nitrate. (Syn., Arg. Nit. Fus., Fused Silver Nitrate, Lunar Caustic, Lapis Infernalis; Br. Argenti Nitras Induratus, Toughened Caustic; Fr. Azotas (Nitras) Argenticus Fusus, Azotate (Nitrate) d'Argent fondu, Pierre infernale; Ger. Argentum nitricum (fusum), Gehärteter Höllenstein, Geschmolzenes Saltpetersaures Silberoxyd.)

Manufacture: Add hydrochloric acid 4 Gm. to silver nitrate 100 Gm., melt, stir, mold. It is a white hard solid, generally in pencils or cones, fibrous fracture, gray, grayish-black on exposure to light, odorless, bitter, caustic, strongly metallic taste; contains 94.5 p. c. of pure salt. *Tests* and *Impurities:* Same as for argenti nitras. The hydrochloric acid forms some silver chloride that toughens the compound, permitting more ready handling without breaking. Should be kept dark, in dark amber-colored vials.

PROPERTIES AND USES.—Alterative, stimulant, astringent (only externally), hæmostatic, escharotic (but does not act deeply), sedative, epilepsy, chronic spinal inflammation, locomotor ataxia, spasmodic tabes, ulcerations of alimentary tract, subacute gastritis, pyrosis, ulcer of stomach, chronic diarrhœa, catarrh of the gall-ducts, typhoid fever, neuralgia, dysentery, cholera, vomiting of pregnancy, chronic jaundice, abnormal heart-action, bronchitis. Externally—diphtheritic exudations, croup (10 p. c.), chronic ulceration, simple inflammation, chronic laryngitis (1–5 p. c.), aphonia, whooping-cough, sore throat of speakers, tubercular and syphilitic tonsillitis, enlarged lymphatic glands, abscesses, iritis, sciatica, conjunctivitis ($\frac{1}{2}$–1 p. c.), corneal ulcers, hemorrhages from leech-bites, bed-sores, poisoned and other wounds, mercurial sore mouth, chancre, smallpox, herpes, intertrigo, burns, erysipelas, gonorrhœa, leucorrhœa, otorrhœa, neck of bladder inflammation, vesical catarrh, urethral strictures, involuntary seminal emissions, enlarged prostate, corns, rectal ascarides.

Also much used in making indelible ink, dyes for hair, beard, etc. When used on the hair for a long time the system usually absorbs sufficient to produce poisonous symptoms, with permanent constitutional weakness. The stains may be removed by applying a solution of potassium cyanide, or potassium iodide, or tincture iodine + ammonia.

Poisoning: Have intense abdominal pain, muscular spasms, vomiting, purging, face livid, skin moist, black vomit containing coagulated mucus, coma, convulsions, paralysis, respiratory disturbance; when chronic have skin, conjunctivæ, and labial mucous membrane of a permanent slaty color, gastric ulceration. Administer weak draught of sodium chloride (to decompose the nitrate), egg-white, milk, tannin, followed by emetic, opium for pain, sodium hyposulphite baths, stimulants—alcohol, strychnine, atropine, etc.; *chronic silver-poisoning, argyria*, which gives slate-blue color to skin, livid cadaveric appearance, is usually not curable but palliated by potassium iodide.

Incompatibles: Alkalies, carbonates, chlorides, hydrochloric acid, tannin, potassium iodide, arsenic solution.

Synergists: Copper, lead, zinc.

Argenti Oxidum. Silver Oxide, Ag_2O.—(Syn., Arg. Oxid., Oxidum Argenticum, Argentum Oxydatum, Argentic Oxide; Fr. Oxyde d'Argent; Ger. Silberoxyd.)

Manufacture: Shake silver nitrate solution with liquor potassii hydroxidi, wash precipitate—$2AgNO_3 + 2KOH = Ag_2O + 2KNO_3 + H_2O$. It is a heavy, brownish-black powder, easily reduced by exposure to light, odorless, metallic taste, slightly soluble in water with alkalinity, insoluble in alcohol, soluble in nitric acid; decomposes at 300° C. (572° F.), liberating oxygen, with residue of metallic silver; contains 99.6 p. c. of pure salt. *Impurities:* Copper, chloride. Should be kept in well-stoppered, dark amber-colored vials, and must not be triturated with readily oxidizable or combustible substances, nor brought in contact with ammonia. Dose, gr. $\frac{1}{4}$–2 (.016–.13 Gm.), ter die, in pill; externally, ointment (10–20 p. c.).

PROPERTIES AND USES.—Similar to nitrate, but much weaker. Slight caustic, sedative; nausea, cardialgia, pyrosis, pains in the stomach, dysentery, diarrhœa, night-sweats, dysmenorrhœa, menorrhagia, leucorrhœa, dilated uterus with flooding, tænia, venereal sores, gonorrhœa, hemorrhages, gastric ulcers, dyspepsia, catarrhal affections, colors skin somewhat.

Incompatibles: Chlorides, organic substances, creosote, etc.; these are oxidized, forming explosive compounds.

Allied Salts:

1. *Argenti Cyanidum. Silver Cyanide*, AgCN, official 1840–1910.—Obtained by distilling potassium ferrocyanide, sulphuric acid, and water together, passing the evolved gas, HCN, into an aqueous solution of silver nitrate, washing, drying the precipitate—$AgNO_3 + HCN = AgCN + HNO_3$; or add solution of silver nitrate to a solution of potassium cyanide until precipitation ceases, filter, wash well—$AgNO_3 + KCN = AgCN + KNO_3$. It is a white powder, odorless, tasteless, permanent in dry air, brownish on exposure to light, insoluble in water, alcohol, cold nitric acid, soluble in boiling nitric acid, ammonia water, sodium thiosulphate T. S., potassium cyanide T. S., fused gives off cyanogen gas, leaving residue of metallic silver (80.48 p. c.); contains 99.9 p. c. of pure salt, corresponding to 80.48 p. c. of metallic silver. Should be kept dark, in dark amber-colored bottles. Rarely used in

medicine, but in preparing diluted hydrocyanic acid. Dose, gr. $\frac{1}{60}$–$\frac{1}{20}$ (.001–.003 Gm.).

2. *Argenti Iodidum. Silver Iodide,* AgI, official 1880–1900.—Obtained by double decomposition between silver nitrate and potassium iodide, washing and drying the precipitate—$AgNO_3 + KI = AgI + KNO_3$. It is a heavy, amorphous, yellow powder, unaltered by light; if impure becomes greenish-yellow, odorless, tasteless, insoluble in water, alcohol, diluted acids, soluble in solution of potassium cyanide. *Impurities:* Chloride, bromide. Should be kept in the dark, in amber-colored vials. Dose, gr. $\frac{1}{4}$–2 (.016–.13 Gm.), ter die, in pill. Similar to nitrate, and from its not coloring the skin, once was believed a better salt, but not now so considered; used in syphilis, visceral neuralgia, asthma, chorea, whooping-cough.

3. *Argenti Nitras Mitigatus. Mitigated Silver Nitrate, Diluted Silver Nitrate,* official 1880–1910.—Obtained by melting together at low temperature in porcelain crucible silver nitrate 30 Gm. and potassium nitrate 60 Gm., stirring until it flows smoothly, pouring into molds. Should be kept dark, in dark amber-colored bottles. Used when mild action desired.

4. *Silver Vitellin. Argyrol.*—This is obtained by extracting and purifying one of the wheat proteids, gliadin (similar to vitellin), and heating it 3 hours under pressure in an autoclave with diluted hydrochloric acid; to a concentrated solution of this salt add strong solution silver nitrate, dry precipitate in vacuo; contains 30 p. c. of metallic silver; occurs in black hygroscopic scales, soluble in water without deteriorating, coagulating albumin, or precipitating chlorides. Used locally in acute inflammations in 5–10–20–50 p. c. solutions—gonorrhœa (5 p. c.), chronic urethritis (5–10 p. c.), cystitis (10 p. c.), purulent conjunctivitis (25–50 p. c.), rhinitis, pharyngitis, laryngitis, vaginitis, dysentery; internally, gastric ulcer, gastritis, gastro-enteritis. Dose, gr. 5–10 (.3–.6 Gm.).

5. *Protargol. Protargolum.* Protein Silver Salt.—Obtained by the interaction of a silver salt and protein, rendering product soluble with solution of albumoses. Occurs as impalpable yellow powder, soluble in water (2 parts) from which silver is not precipitated by ordinary reagents—alkalies, sulphides, bromides, chlorides, iodides, heat, etc. Bactericide, antiseptic, non-irritating substitute for silver salts in gonorrhœa, conjunctivitis, cystitis, urethritis, mucous membranes of eye, ear, nose, throat. Dose, only externally: gonorrhœa (acute) injections .25–1 p. c., (chronic) 5–10 p. c.; irrigations 1 in 1000 or 2000; also as bougies and tampons (5–10 p. c.).

HYDRARGYRUM. MERCURY.

$Hg^{ii} = 200.6.$

(Syn., Hydrarg., Quicksilver, Hydrargyrum Vivum, Mercurius Vivus, Argentum Vivum; Fr. Mercure, Vif Argent; Ger. Quecksilber.)

The element mercury (after the messenger of the gods, from its mobility, quicksilver, similar origin; L. *hydrargyrum;* Gr. ὕδωρ, water, + ἄργυρος, whiteness, lustre) is found as globules in the metallic state and as mercuric sulphide, cinnabar, in mines of Spain, Austria, California, Peru, Japan, Mexico. The metal is obtained by roasting cinnabar in the air, which dissipates SO_2, and leaves Hg behind; or may distil it with lime, which combines with the sulphur, and the mercury, being volatile, is conveyed into cooling chambers, where it condenses. It is a shining, silver-white metal, liquid at ordinary temperatures, easily divisible into spherical globules; at —40° C. (—40° F.) forms a ductile, malleable mass; odorless; tasteless; sp. gr. 13.5; insoluble in ordinary solvents, concentrated hydrochloric acid, sulphuric acid (dissolving in latter when boiled); soluble in nitric acid; contains 99. 5 p. c. of pure mercury; forms 2 series of compounds: *mercuric* (Hg), *mercurous* (Hg_2). *Tests:* 1. At ordinary temperature—volatilizes slowly, more rapidly with increased heat; boils at 358° C. (677° F.), volatilizes with residue .02 p. c. 2. Dropped upon white paper—globules roll about freely, retain form, and leave no streaks or traces. 3. Must be dry, with bright surface even after agitation in contact with air.

Tests for Mercury Salts: 1. H_2S or NH_4SH precipitates black mercuric (and mercurous) sulphide. 2. KI precipitates green mercurous iodide and red mercuric iodide, soluble in excess. 3. Potassium, sodium, or calcium hydroxide precipitates brownish-black mercurous oxide (Hg_2O) and yellow mercuric oxide (HgO). 4. Ammonium hydroxide precipitates black mercurous ammonium salt and white mercuric ammonium salt. 5. Metallic copper placed in acid mercuric solution soon becomes coated with metallic mercury.

PREPARATIONS.—1. *Hydrargyrum cum Creta.* Mercury with Chalk. (Syn., Hydrarg. cum Cret., Gray Powder, Æthiop's Cretaceus; Fr. Mercure avec la Craie; Poudre de Mercure crayeux; Ger. Quecksilber mit Kreide.)

Manufacture: Shake by hand, or mechanically, mercury 38 Gm., clarified honey 10, water 2 Ml. (Cc.), in a strong bottle, until globules no longer visible under lens magnifying 4 diameters (10 hours); rub prepared chalk 57 Gm. with water q. s. for creamy paste, add contents of bottle, triturate to uniform mixture, dry to 100 Gm., pulverize. It is a light gray, rather damp powder, non-gritty, odorless, slightly sweet taste; contains 37–39 p. c. of mercury. *Impurities:* Mercurous oxide, mercuric oxide. Should be kept dark, in well-closed containers, owing to ready oxidation of so finely divided mercury. Dose, gr. 5–10 (.3–.6 Gm.), twice daily; children, gr. $\frac{1}{6}$–3 (.01–.2 Gm.).

2. *Massa Hydrargyri.* Mass of Mercury. (Syn., Mass. Hydrarg., Blue Mass, Blue Pill, Massa Cœrulea, Pilulæ Cœruleæ; Br. Pilula Hydrargyri, Mercury Pill; Fr. Masse pilulaire bleue, Pilule de Mercure; Ger. Mercurial Pillen (masse).)

Manufacture: 33 p. c. Triturate oleate of mercury 1 Gm. in a warm mortar, gradually add mercury 33 Gm., and then gradually honey of rose 32 Gm., triturating until globules of mercury are no longer visible under a lens magnifying 10 diameters; add gradually glycerin 9, glycyrrhiza 10 Gm. and althæa 15 Gm.; triturate until mass homogeneous. Dose, gr. 3–15 (.2–1 Gm.).

3. *Unguentum Hydrargyri.* Mercurial Ointment. (Syn., Ung. Hydrarg., Blue Ointment, Unguentum (Mercuriale) Neapolitanicum; Br. Mercury Ointment; Fr. Pomatum cum Hydrargyro, Pommade (Onguent) Mercurielle à parties égales, Pommade napolitaine; Ger. Quecksilbersalbe.)

Manufacture: 50 p. c. Triturate oleate of mercury 2 Gm., in a warm mortar, with mercury 50 Gm., added gradually, until globules completely divided and distributed, set aside for 15 minutes; melt benzoinated lard 25 Gm., prepared suet 23 Gm., allow to cool partially, add 2.5 Gm. of it to the mercurial mixture, triturate until globules of mercury are no longer visible under a lens magnifying 10 diameters, then incorporate the remainder, mix thoroughly.

Prep.: 1. *Unguentum Hydrargyri Dilutum.* Diluted Mercurial Ointment. (Syn., Ung. Hydrarg. Dil., Blue Ointment; Fr. Onguent mercuriel dilué; Ger. Unguentum Hydrargyri Cinereum, Verdünnte Graue Quecksilbersalbe.)

Manufacture: 30 p. c. Mix thoroughly mercurial ointment 60 Gm., petrolatum 40 Gm. When for hot-weather use, may replace 5–10 p. c. of petrolatum by yellow wax.

4. *Unguentum Hydrargyri Nitratis.* Ointment of Mercuric Nitrate. (Syn., Ung. Hydrarg. Nit., Citrine Ointment, Unguentum (Hydrargyri) Citrinum; Fr. Pomatum Citrinum, Pommade Citrine, Onguent Citrin; Ger. Quecksilbernitratsalbe.)

Manufacture: Melt in a porcelain dish lard 76 Gm., at 45° C. (113° F.), add nitric acid 7 Gm., at once, continue heat until characteristic reaction is complete, holding an inverted glass funnel over the dish to protect operator from spurting lard; withdraw heat immediately after rapid rise of froth accompanying the end of reaction, cool, stirring until it assumes a bright citrine color; dissolve mercury 7 Gm. in nitric acid 10.5 Gm., warming if necessary to prevent crystallizing, and add it to the prepared lard; avoid metallic utensils and containers.

Unoff. Preps.: Emplastrum Hydrargyri; mercury 30 Gm., oleate of mercury 1 Gm., hydrous wool fat 10 Gm., melted lead plaster q. s. 100 Gm. *Linimentum Hydrargyri* (Br.), 40 p. c. *Petroxolinum Hydrargyri,* 30 Gm., + hydrous wool fat 13, oleic acid 2, solid petroxolin 55. *Unguentum Hydrargyri Compositum* (Br.); mercury ointment 40 p. c. (Hg 12 p. c.). *Unguentum Hydrargyri Nitratis* (Br.); mercury 10 Gm., nitric acid 30 Ml. (Cc.), prepared lard 40 Gm., olive oil 70 Gm. *Unguentum Hydrargyri Nitratis Dilutum* (Br.); mercuric nitrate ointment 20 Gm., soft paraffin, yellow 80 Gm.

PROPERTIES AND USES.—Mercury—stimulant, alterative, tonic, antiphlogistic, sorbefacient, not directly a cholagogue, causes salivation; the liver retains it longest. Used in meningitis, bronchitis, pleuritis, pneumonitis, dysentery, rheumatism hydrocephalus, ascites, hydrothorax, dropsy, intestinal obstruction, malarial enlargement of spleen, smallpox. Plaster—applied to syphilitic nodes, glandular engorgements, enlarged spleen, to cover face in smallpox. It not only gives support, but is also a counter-irritant, while the mercury is absorbed and exerts a constitutional effect. Mercury with Chalk—similar to blue mass, only much weaker. Give to children deficient in biliary secretion, indicated by clay-colored stools, bowel complaints, diarrhœa, alterative to constitutional syphilis; the chalk is antacid. Blue Mass—sialagogue, alterative, irritant, cathartic; for the first two give gr. 3 (.2 Gm.) nightly or on alternate nights, following in the morning with a laxative; for the last give gr. 5–15 (.3–1 Gm.), at night and follow in the morning with a more active purgative; useful to increase liver and pancreas secretions. Mercurial and Blue Ointments —excellent externally, get resolvent effect by rubbing either upon the swollen or affected parts, and also a constitutional influence. Used in syphilis, when daily inunctions should be made under arms, flanks, thighs, chest, etc., swellings, glandular enlargements, engorged liver, spleen, inflamed joints, orchitis, smallpox eruption, erysipelas, prurigo pudendi, warts, and condylomata. Mercuric Nitrate Ointment—stimulant, alterative, similar to ointments of ammoniated mercury and red mercuric oxide, more stimulating than the former, often occasions salivation; eczema, Tinea capitis, impetigo larvalis, psoriasis, pityriasis, psorophthalmia, and inflammation of eye, eyelids, etc.

Hydrargyri Iodidum Flavum. Yellow Mercurous Iodide, HgI.—(Syn., Hydrarg. Iod. Flav., Mercurous Iodide, Protoiodide of Mercury, Yellow Iodide of Mercury, Hydrargyri (Proto-ioduretum) Iodidum Viride, Ioduretum Hydrargyrosum; Fr. Proto-iodure de Mercure, Iodure mercureux; Ger. Quecksilberjodid (jodür). Gelbes Jodquecksilber.)

Manufacture: Mix nitric acid and distilled water each 20 Ml. (Cc.), cool, pour it upon mercury 50 Gm., after reaction separate, drain, and dry crystals ($HgNO_3 + H_2O$); dissolve 40 Gm. in distilled water 650 Ml. (Cc.) + nitric acid 6 Ml. (Cc.), to which add slowly, with stirring, potassium iodide 16 Gm. dissolved in distilled water 32 Ml. (Cc.), wash well and dry precipitate—$6Hg + 8HNO_3 = 6Hg(NO_3) + 4H_2O$; $2Hg(NO_3) + 2KI = 2HgI + 2KNO_3$. It is a bright yellow, amorphous powder, odorless, tasteless, on exposure to light greenish in proportion as it decomposes into metallic mercury and mercuric iodide; insoluble in alcohol, ether, almost insoluble in water; contains 99 p. c. of pure salt. *Tests:* 1. Slow moderate heat—orange, red, but yellow on cooling; quick strong heat—partially decomposes into mercury and mercuric iodide, finally volatilizes with residue .2 p. c. 2. Heat with dried sodium carbonate (1) in dry glass tube—sublimate of metallic mercury. 3. Heat with sulphuric acid + little manganese dioxide—iodine vapor evolved. *Impurities:* Mercuric iodide, etc. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{6}$–1 (.01–.06 Gm.), ter die, gradually increased until trebled, provided salivation or diarrhœa does not occur.

PROPERTIES AND USES.—In advanced constitutional syphilis, being by many considered the best salt for this disease.

Hydrargyri Chloridum Corrosivum. Corrosive Mercuric Chloride, $HgCl_2$.—(Syn., Hydrarg. Chlor. Corr., Bichloride of Mercury, Corrosive Sublimate, Mercuric Chloride, Perchloride of Mercury, Chloruretum (Chloretum) Hydrargyricum; Br. Hydrargyri Perchloridum; Fr. Deuto-chlorure de Mercure, Chlorure mercurique; Ger. Hydrargyrum bichloratum, Quecksilberchlorid, Sublimat.)

Manufacture: Sublime an intimate mixture of powdered mercuric sulphate and sodium chloride, when the two volatile elements, Hg, Cl, pass over and condense in the cooler as mercuric chloride—$HgSO_4 + 2NaCl = HgCl_2 + Na_2SO_4$; or may add a small portion of manganese dioxide to insure full liberation of chlorine and prevent the formation of mercurous chloride—$HgSO_4+2NaCl+MnO_2 = HgCl_2+ Na_2SO_4 + MnO_2$. It is in heavy, colorless, rhombic crystals, crystalline masses, white powder, odorless, characteristic, persistent metallic taste (use great caution in tasting), permanent, soluble in water (13.5), boiling water (2.1), alcohol (3.8), boiling alcohol (1.6), glycerin (12), ether (22), fuses to colorless liquid at 265° C. (509° F.), volatilizes in dense white vapors at 300° C. (572° F.), leaving residue .1 p. c.; aqueous solution (1 in 20) acid, but neutral upon adding sodium chloride; contains 99.5 p. c. of the salt. *Tests:* 1. Aqueous solution with ammonia water—white precipitate; with excess of hydrogen sulphide—black precipitate; with potassium iodide T. S.—red precipitate, soluble in excess of reagent; with silver nitrate T. S.—white precipitate, insoluble in nitric acid. 2. Dissolve (fine powder) in ether or alcohol—undissolved residue .5 p. c. Should be kept in well-closed containers. Dose, gr. $\frac{1}{50}$–$\frac{1}{8}$ (.0013–.008 Gm.), after meals, in bread pill; as antiseptic dressing the solution (1 in 1000–2000) is valuable.

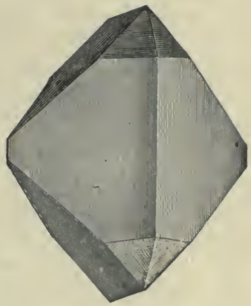


FIG. 464.—Corrosive mercuric chloride crystal.

Incompatibles: Alkalies, their carbonates, potassium iodide, lime water, tartar emetic, lead acetate, silver nitrate, albumin, soap, tannin.

PREPARATIONS.—1. *Toxitabellæ Hydrargyri Chloridi Corrosivi.* Poison Tablets of Corrosive Mercuric Chloride. (Syn., Toxitabel. Hydrarg. Chlor. Corr., Corrosive Sublimate Tablets, Bichloride Tablets.)

Manufacture: By compressing equal quantities (7.5 gr. (.5 Gm.)) of corrosive mercuric chloride and sodium chloride, colored blue, preferably with sodium indigotindisulphonate. Tablets must be of angular shape (not discoid), and have stamped distinctly upon each the word "POISON," and the skull-and-cross-bones design; each must weigh gr. 15 (1 Gm.), and contain .45–.55 Gm. of corrosive mercuric chloride and the remainder chiefly sodium chloride; they must be dispensed in securely stoppered glass containers bearing a red label with the word "POISON," and a statement indicating that the tablets contain the required amount of corrosive mercuric chloride.

2. *Hydrargyrum Ammoniatum.* Ammoniated Mercury, $HgNH_2Cl$. (Syn., Hydrarg. Ammon., White Precipitate, Mercuric Ammonium Chloride, Hydrargyrum Ammoniato-muriaticum (Amidato-bichloratum), Hydrargyri Ammonio-chloridum, Mercurius Præcipitatus Albus, Mercur-ammonium Chloride; Fr. Chloramidure de Mercure, Oxychlorure Ammoniacal de Mercure, Lait Mercuriel, Mercure Précipité blanc; Ger. Hydrargyrum præcipitatum album, Weisser Quecksilberpräcipitat, Quecksilber Chloridamid.)

Manufacture: Dissolve corrosive mercuric chloride 100 Gm. in warm distilled water 2000 Ml. (Cc.), filter, cool, and pour gradually into ammonia water 150 Ml. (Cc.), constantly stirring, wash precipitate with distilled water 400 Ml. (Cc.), + ammonia water 20 Ml. (Cc.), dry—$HgCl_2 + 2NH_4OH = HgNH_2Cl + NH_4Cl + 2H_2O$. It is in white pulverulent pieces or white, amorphous powder, odorless, earthy, styptic, metallic taste, permanent; soluble in warm hydrochloric, nitric, or acetic acid, cold solution of ammonium carbonate or sodium thiosulphate, with evolution of ammonia which heated—red mercuric sulphide separates; boiled—turns black; insoluble in water, alcohol; by prolonged washing with water gradually decomposes, becoming yellow, basic salt; contains 78–80 p. c. of pure salt. *Tests:* 1. Heat below redness—decomposes without fusion; at red heat—volatilizes with residue .2 p. c. 2. Heat with potassium hydroxide T. S.—turns yellow, evolves ammonia. 3. Dissolve in diluted nitric acid, + potassium iodide T. S.—red precipitate, soluble in excess of reagent; with silver nitrate T. S.—white precipitate. *Impurities:* Mercurous salts, carbonates. Should be kept dark, in well-closed containers.

Prep.: 1. *Unguentum Hydrargyri Ammoniati.* Ointment of Ammoniated Mercury. (Syn., Ung. Hydrarg. Ammon., White Precipitate Ointment, Unguentum Præcipitati Albi; Fr. Pommade de Précipité blanc; Ger. Unguentum Hydrargyri album, Quecksilberpräzipitatsalbe.)

Manufacture: 10 p. c. Rub ammoniated mercury 10 Gm. with an equal weight of melted white petrolatum, add melted white petrolatum 40 Gm., mix thoroughly with hydrous wool fat 40 Gm., stir until congealed.

3. *Hydrargyri Iodidum Rubrum.* Red Mercuric Iodide, HgI_2. (Syn., Hydrarg. Iod. Rub., Biniodide of Mercury, Mercuric Iodide, Red Iodide of Mercury, Deuto-ioduretum (Biniodidum) Hydrargyri, Mercurius Iodatus Ruber, Ioduretum Hydrargyricum; Fr. Deuto-iodure (Bi-iodure) de Mercure, Iodure mercurique; Ger. Hydrargyrum bijodatum, Quecksilberjodid, Rotes Jodquecksilber.)

Manufacture: Dissolve corrosive mercuric chloride 40 Gm. and potassium iodide 50 Gm., each, in distilled water 800 Ml. (Cc.), filter, pour slowly both simultaneously into water 2000 Ml. (Cc.), wash well and dry precipitate—$HgCl_2 + 2KI = HgI_2 + 2KCl$. It is a scarlet-red, amorphous powder, odorless, tasteless, permanent, soluble in alcohol (115), boiling alcohol (20), chloroform (910), ether (120), solutions of soluble iodides, mercuric chloride, sodium thiosulphate, hot solutions of alkali chlorides; almost insoluble in water; contains 99 p. c. of pure salt. *Tests:* 1. Heat to 150° C. (302° F.)—yellow, but red on cooling; at higher temperature fuses to dark yellow liquid, which, on cooling—yellow crystalline mass; at higher heat—volatilizes with residue .2 p. c. 2. Heat with potassium hydroxide T. S., + little sugar of milk—compound reduced, metallic mercury precipitated. 3. Boil .1 Gm. with potassium hydroxide T. S. 2 Ml. (Cc.), supersaturate filtrate with nitric acid—yellow liquid from liberation of iodine; blue with starch T. S. *Impurities:* Soluble mercury salts. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{50}$–$\frac{1}{8}$ (.0013–.008 Gm.).

Prep.: 1. *Liquor Arseni et Hydrargyri Iodidi.* Solution of Arsenous and Mercuric Iodide. (Syn., Liq. Arsen. et Hydrarg. Iod., Donovan's Solution, Solution of Hydriodate of Arsenic and Mercury, Solutio Donovani; Fr. Soluté d'Iodo-arsénite de Mercure Liqueur de Donovan; Ger. Jodquecksilber-Arseniklösung, Donovansche Tropfen.)

Manufacture: Rub together in a mortar arsenous iodide and red mercuric iodide, each, 1 Gm., add distilled water 15 Ml. (Cc.), triturate until dissolved, filter, pass through filter water q. s. 100 Ml. (Cc.); mix thoroughly. It is a clear, colorless, pale yellowish, aqueous liquid, odorless, disagreeable metallic taste; contains .95–1.05 p. c. of each, arsenous iodide, AsI_3, and red mercuric iodide, HgI_2. *Tests:* 1. Mix 1 Ml. (Cc.) with distilled water 10 Ml. (Cc.), containing a few drops of lead acetate T. S.—bright yellow precipitate. 2. Add a few drops to a mixture (zinc .5 Gm. + diluted hydrochloric acid 5 Ml. (Cc.)), cover mouth of test-tube with filter paper moistened with mercuric chloride T. S. and dried—in 1 minute a yellow stain on inner surface of filter paper. Should be kept in well-filled, amber-colored bottles; must not be dispensed if darker than pale yellow. Dose, ♏iij–5 (.2–.3 Ml. (Cc.)), ter die, diluted.

Unoff. Preps.: Liquor Hydrargyri et Potassii Iodidi: 2.5 Gm., potassium iodide 2, dist. water q. s. 250. *Mulla Hydrargyri Chloridi Corrosivi* .2 p. c., + benz. suet 90, benz. lard 5, alcohol 6. *Unguentum Hydrargyri Iodidi Rubri* (Br.), 4 p. c.

4. *Hydrargyri Oxidum Flavum.* Yellow Mercuric Oxide, HgO. (Syn., Hydrarg. Oxid. Flav., Hydrargyrum Oxidatum Flavum (Præcipitatum), Precipitated Oxide of Mercury or Mercuric Oxide; Fr. Oxyde mercurique jaune (précipité), Oxyde de Mercure jaune ou précipité, Deutoxide jaune de Mercure; Ger. Hydrargyrum oxydatum via humida paratum, Gelbes (Præcipitirtes) Quecksilberoxyd.)

Manufacture: Dissolve corrosive mercuric chloride 100 Gm. in warm distilled water 1000 Ml. (Cc.), filter, also dissolve sodium hydroxide 40 Gm. in cold distilled water 1000 Ml. (Cc.) and to this add first solution, constantly stirring, wash well and dry precipitate —$HgCl_2 + 2NaOH = HgO + 2NaCl + H_2O$. It is a light orange-yellow, amorphous, heavy, impalpable powder, odorless, metallic taste, permanent in air, darkens on exposure to light; soluble in diluted hydrochloric or nitric acid (colorless solutions); insoluble in alcohol, almost insoluble in water; moistened with hot distilled water—not alkaline; contains 99.5 p. c. of pure salt. *Tests:* 1. Heat moderately—red; at red heat—decomposes completely into oxygen and metallic mercury, finally volatilizes with residue .2 p. c. 2. Dissolve .5 Gm. in 25 Ml. (Cc.) of diluted hydrochloric or nitric acid—solution not more than slightly turbid. *Impurities:* Red mercuric oxide, etc. Should be kept dark, in well-closed containers.

Preps.: 1. *Unguentum Hydrargyri Oxidi Flavi.* Ointment of Yellow Mercuric Oxide. (Syn., Ung. Hydrarg. Oxid. Flav.; Fr. Pommade d'Oxyde jaune de Mercure; Ger. Gelbe Quecksilberoxydsalbe.)

Manufacture: 10 p. c. Triturate until smooth mixture yellow mercuric oxide 10 Gm. with water 10 Gm., add hydrous wool fat 40 Gm., in divided portions, and incorporate thoroughly with petrolatum 40 Gm.; avoid metallic utensils and containers.

2. *Oleatum Hydrargyri.* Oleate of Mercury. (Syn., Oleat. Hydrarg., Hydrargyrum Oleicum—Oleïnicum—Elaïnicum; Br. Hydrargyrum Oleatum, Oleated Mercury, Mercuric Oleate; Fr. Oléate mercurique (de Mercure); Ger. Oelsaures Quecksilber, Quecksilberoleat, Mercurioleat.)

Manufacture: Mix in a tared dish yellow mercuric oxide 25 Gm. with alcohol 20 Ml. (Cc.), add oleic acid 75 Gm., warm to 50° C. (122° F.), stir constantly for 5 minutes, continue heat, stirring frequently, until alcohol expelled and yellow mercuric oxide dissolved, add oleic acid q. s. 100 Gm.; avoid contact with metallic utensils. Should be kept dark, in tightly-closed containers, and not dispensed if globules of mercury are visible at the bottom of container. This may well be substituted for mercurial ointment, as it is absorbed more readily; for inflamed joints, indurations following abscesses, sycosis, tineæ, psoriasis, eczema, hereditary syphilis.

Prep.: *Unguentum Hydrargyri*, 2 p. c.

5. *Hydrargyri Salicylas.* Mercuric Salicylate. (Syn., Hydrarg. Salicyl., Mercuric Subsalicylate; Fr. Salicylate mercurique; Ger. Hydrargyrum salicylicum, Mercurisalicylsaure.)

Manufacture: Dissolve corrosive mercuric chloride (27) in water (600), add it to a 4 p. c. sodium hydroxide solution (85) mixed with water (200), wash precipitate (oxide), digest it with water (little) + salicylic acid (15) on water-bath until mixture pure white. It is a white, slightly yellowish or pinkish powder; odorless; tasteless; soluble in solutions of fixed alkalies or their carbonates, warm solutions of alkali halides forming double salts; nearly insoluble in water, alcohol;

contains 54–59.5 p. c. of mercury. *Tests:* 1. Heat 1 Gm. with hydrochloric acid (10 Ml. (Cc.))—salicylic acid separates on cooling; copper foil added to solution—becomes coated immediately with metallic mercury; another portion + ferric chloride T. S.—violet color. 2. Incinerate .5 Gm.—residue .2 p. c. *Impurities:* Foreign mercury compounds, free salicylic acid. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{6}$–1 (.01–.06 Gm.), 2–3 times daily; hypodermically with equal quantity of potassium carbonate in distilled water.

Unoff. Preps.: Liquor Hydrargyri Perchloridi (Br.), .1 p. c., dose, ʒss–1 (2–4 Ml. (Cc.)). *Lotio* (*Hydrargyri*) *Flava*, .3 Gm., boiling water 3.5, sol. calcium hydroxide q. s. 100. *Unguentum Hydrargyri Oleati* (Br.), 25 p. c.

PROPERTIES AND USES.—Corrosive Sublimate—like many mercury compounds, is tonic, alterative, diuretic, antiseptic, disinfectant, irritant poison; seldom purges, and this can always be prevented by combining it with opium; large doses cause vomiting, griping pain in bowels, diarrhœa, small, irregular pulse; good in advanced syphilis, chronic skin affections and rheumatism, condylomata, engorged glands, diphtheria, pneumonia (injections). Externally—pseudomembranous laryngitis, fetid bronchitis, phthisis, skin diseases (psoriasis, acne, freckles, prurigo pudendi, pityriasis), ophthalmia, granular conjunctivitis, rhus-poisoning, malignant pustule, gonorrhœa, leucorrhœa, dysentery, cholera, hydrocele, wounds, ulcers, arthritis, parasites (pediculi pubis, etc.), vascular tumors. With lime water have yellow wash (*lotio flava, aqua phagedœnica flava*), $\frac{3}{10}$ p. c., used for ill-conditioned sores, ulcers, etc. Ammoniated Mercury—is a less active irritant than some other salts; it is poisonous, and owing to careless manufacture (permitting exposure to light) often contains corrosive mercuric chloride; it is not given internally, and the ointment is of most service in ophthalmia and skin diseases. Red Iodide—is a powerful irritant poison; scrofula, constitutional syphilis, rheumatic pains. Externally—stimulant to indolent syphilitic and scrofulous ulcers, glandular swellings, lupus, goitre, enlarged spleen or liver, granular eyelids, bronchitis, disinfectant; may be applied in solution with potassium iodide (1 in 50), or ointment (1–4 in 20). Donovan's Solution—is given as an alterative in psoriasis, impetigo, porrigo, lepra, pityriasis, lupus, venereal eruptions, chronic rheumatism, night-pains. Yellow Oxide—externally as stimulant escharotic in powder or ointments; chancres, indolent ulcers, corneal ulcers. Salicylate—claimed to be borne best with least influence on alimentary tract, most effective in syphilis, without salivation.

Poisoning: Toxic doses of corrosive sublimate (red iodide, etc.) resemble those of arsenic in effect—have strong metallic taste, frequent bloody evacuations, tenesmus, feeling of constriction in throat, burning in œsophagus and stomach, swollen lips and tongue, quick, irregular pulse, cold extremities, intense abdominal pains, vomiting, labored respiration, suppressed urine, syncope, salivation, insensibility, convulsions, death. Give egg-white, beaten up with water (1 egg for every

4 grains), follow at once with emetic to remove, hence avoid re-solution of albuminous mercuric compound, demulcents, milk, flour-paste, meat-broth, opiates, potassium iodide, stimulants, heat.

Hydrargyri Chloridum Mite. Mild Mercurous Chloride, HgCl.—(Syn., Hydrarg. Chlor. Mit., Mercurous Chloride, Calomel, Protochloride of Mercury, Subchloride of Mercury, Hydrargyri Chloridum, Hydrargyrum Chloratum (Muriaticum) Dulce, Mercurius Dulcis, Calomelas, Chloruretum (Chloretum) Hydrargyrosum; Br. Hydrargyri Subchloridum; Fr. Protochlorure (Sous-muriate) de Mercure, Mercure doux; Ger. Hydrargyrum chloratum, Quecksilberchlorür, Kalomel.)

Manufacture: Rub mercury (7) with mercuric sulphate (10) to form mercurous sulphate, sublime this with sodium chloride (5), conducting the vapors into a chamber admitting steam simultaneously for dissolving and removing the small amount of mercuric chloride always formed—$Hg. + 2H_2SO_4 = HgSO_4 + SO_2 + 2H_2O$; $HgSO_4 + Hg = Hg_2SO_4$; $Hg_2SO_4 + 2NaCl = 2HgCl + Na_2SO_4$. It is a white, impalpable powder, yellowish-white when triturated with strong pressure, showing only small, isolated crystals under magnifying power of 100 diameters; odorless, tasteless, permanent; insoluble in water, alcohol, ether, cold dilute acids; strongly heated volatilizes without fusion or evolution of brown vapors, leaving residue .1 p. c.; contains 99.6 p. c. of the salt. *Tests:* 1. Contact with calcium hydroxide T. S. solutions of alkali hydroxides, or ammonia water—blackens. 2. Heat with equal weight of dried sodium carbonate in glass tube—sublimate of metallic mercury, which dissolved in nitric acid, + silver nitrate T. S.—white, curdy precipitate, insoluble in nitric acid. *Impurities:* Mercuric chloride, ammoniated mercury. Should be kept dark, in well-closed containers. Dose, gr. 1–15 (.06–1 Gm.); laxative gr. 2 (.13 Gm.), alterative gr. 1 (.06 Gm.). Children require more in proportion, thus two to three years old give gr. 2–3 (.13–.2 Gm.), and this dose often fails, when it should be followed by castor oil. Better results are obtained by giving small and often-repeated doses, thus gr. $\frac{1}{10}$ (.006 Gm.) hourly in tablet or powder with sugar or sodium bicarbonate (1 in 10) will usually act freely by time the tenth dose is taken.

PREPARATIONS.—1. *Pilulæ Catharticæ Compositæ,* 1 gr. (.06 Gm.). Dose, 1–3 pills.

Unoff. Preps.: Pulvis Hydrargyri Chloridi Mitis et Jalapæ, mild mercurous chloride 34 p. c., + jalap 66. *Unguentum Hydrargyri Subchloridi* (Br.), 20 p. c. *Lotio (Hydrargyri) Nigra,* .875 Gm., water 1.5, sol. calcium hydroxide q. s. 100.

PROPERTIES AND USES.—Purgative, anthelmintic, alterative, cholagogue. Most valuable mercury salt; lessens biliary secretion, causes salivation. Used for syphilis, typhoid, yellow and remittent fevers, inflammatory diseases, pericarditis, endocarditis, pleurisy, pneumonia, meningitis, hepatitis, dropsy, articular rheumatism, dysmenorrhœa, iritis, jaundice, pseudomembranous laryngitis, bronchitis, dysentery, cholera, lumbricoid worms. With lime water have black wash (*lotio* *nigra, aqua phagedænica nigra*), $\frac{3}{4}$ p. c., used locally to syphilitic ulcers, etc. An ointment (10 p. c.) useful in scaly skin eruptions, condylomata, corneal ulcers, maggots.

Hydrargyri Oxidum Rubrum. Red Mercuric Oxide, HgO.—(Syn., Hydrarg. Oxid. Rub., Red Precipitate, Hydrargyri Nitrico-oxidum, Mercurius Corrosivus (Præcipitatus) Ruber, Peroxide of Mercury, Oxydum Hydrargyricum; Fr. Deut-oxyde (Peroxyde) rouge de Mercure, Oxyde mercurique, Précipité rouge, Poudre de Jean de Vigo; Ger. Hydrargyrum oxydatum (rubrum), (Rotes) Quecksilberoxyd, Roter Präcipitat (Quecksilber Präcipitat).)

Manufacture: Dissolve mercury in nitric acid, then either heat alone or triturate this dried mercuric nitrate with mercury and heat—(1) $Hg_3 + 8HNO_3 = 3Hg(NO_3)_2 + 2NO + 4H_2O$. (2) $2Hg(NO_3)_2 +$ heat $= 2HgO + 4NO_2 + O_2$, or $2Hg(NO_3)_2 + Hg_2 +$ heat $= 4HgO + 2N_2O_4$. It is in heavy orange-red crystalline scales or powder, acquiring yellow color when finely divided; odorless; metallic taste; permanent; soluble in diluted nitric acid (clear solution), hydrochloric acid, 1 in 10 (faint opalescence); insoluble in alcohol, almost insoluble in water; contains 99.5 p. c. of pure salt. *Tests:* 1. Heat to 400° C. (750° F.)—dark violet, black, but original color on cooling; at red heat—decomposes completely into oxygen and metallic mercury, finally volatilizes with residue .2 p. c. 2. Dissolve .5 Gm. in 25 Ml. (Cc.) of hydrochloric or nitric acid—not more than slightly turbid. *Impurities:* Yellow mercuric oxide, nitrate. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{10}$ (.006 Gm.), in syphilis.

PREPARATIONS.—(Unoff.): *Unguentum Hydrargyri Oxidi Rubri,* official 1830–1910, 10 p. c.: red mercuric oxide 10 Gm., hydrous wool fat 40 Gm., petrolatum 40 Gm., water 10, avoid metallic utensils. *Liquor Hydrargyri Nitratis*: red mercuric oxide 40 Gm., nitric acid 45 Gm., distilled water 15 Gm.

PROPERTIES AND USES.—Red Oxide—not used much internally, but mostly externally as stimulant, escharotic; ulcers, wounds, indolent syphilitic sores, condylomata, corneal opacity, granular eyelids, pannus, ozæna, in powder or ointment. The yellow oxide has nearly replaced this salt. Mercuric Cyanide—used instead of corrosive sublimate for constitutional syphilis, diphtheria (gargle 1 in 10,000). Liquor Hydrargyri Nitratis—used as a caustic for cancers, lupus, ulcerations of uterus, chancres, acne, boils, syphilitic sores, very poisonous, which may result even from skin absorption.

Allied Salts:

1. *Hydrargyri Subsulphas Flavus. Yellow Mercuric Subsulphate* (Turpeth Mineral), $Hg(HgO)_2SO_4$, official 1830–1900.—Obtained by dissolving mercury 100 Gm. in sulphuric acid 30 Ml. (Cc.) + distilled water 15 Ml. (Cc.), adding gradually nitric acid 25 Ml. (Cc.) + distilled water 25 Ml. (Cc.), evaporating to dryness, powdering, and adding it gradually to boiling distilled water 2000 Ml. (Cc.), boiling 10 minutes (to convert normal into basic sulphate, the acid sulphate

remaining in solution), washing and drying precipitate—$Hg_3 + 3H_2SO_4 + 2HNO_3 = 3HgSO_4 + 2NO + 4H_2O$. It is a heavy lemon-yellow powder, odorless, tasteless, permanent, soluble in HNO_3, HCl, water (2000), boiling water (600), insoluble in alcohol. *Impurities:* Mercurous salt, lead; should be kept in the dark, in well-stoppered bottles. Alterative, emetic, errhine, irritant poison, salivates; croup, spasmodic laryngitis. Dose, gr. 2–3 (.13–.2 Gm.), for child two years old, repeated in 15 minutes; as alterative for adult, gr. $\frac{1}{4}$–$\frac{1}{2}$ (.016–.03 Gm.); emetic, gr. 2–5 (.13–.3 Gm.); errhine, gr. 1 (.06 Gm.) + starch q. s.; gr. 60 (4 Gm.) have killed.

2. *Hydrargyri Sulphidum Rubrum. Red Sulphide of Mercury. Cinnabar*, HgS, official 1880–1890.—Obtained by gradually adding mercury (40) to melted sublimed sulphur (8), constantly stirring; the mass is heated until it begins swelling, then cooled under close cover, rubbed into powder, and sublimed. It is a mercuric salt, and occurs in brilliant dark red crystalline masses or bright scarlet powder, odorless, tasteless, permanent, insoluble in water, alcohol, nitric or hydrochloric acid, soluble in nitromuriatic acid, sp. gr. 8.12. *Impurities:* Arsenic, antimony, chromates, iodides, sulphides, red oxide of mercury, red oxide of lead. By fumigation as a sialagogue in syphilitic affections.

3. *Hydrargyri Cyanidum. Mercuric Cyanide*, $Hg(CN)_2$, official 1830–1900.—Obtained by dissolving mercuric oxide in hydrocyanic acid, the latter being prepared from potassium ferrocyanide and sulphuric acid—$HgO + 2HCN = Hg(CN)_2 + H_2O$; usually by passing HCN gas into mercuric oxide in water, when soluble $Hg(CN)_2$ is formed, evaporating to crystallize. It is in white prismatic crystals, odorless, bitter, metallic taste, darkens by light, exceedingly poisonous, soluble in water (12.8), alcohol (12). *Impurities:* Mercuric chloride, etc.; should be kept in well-stoppered bottles. Dose, gr. $\frac{1}{16}$–$\frac{1}{8}$ (.004–.008 Gm.).

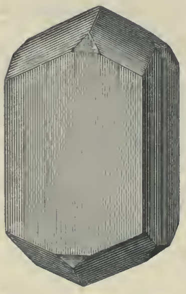


FIG. 465.—Mercuric cyanide crystal.

4. *Mercuric Sulphate-Ethylenediamine. Sublamine*, $HgSO_42C_2H_4(NH_2)_2 + 2H_2O$.

Manufacture: By combining one molecule of mercuric sulphate and two molecules of ethylenediamine. Occurs in white alkaline needles, soluble in water, glycerin (10), sparingly in alcohol; contains 44 p. c. of mercury; does not precipitate albumin, is incompatible with sodium chloride, and should not be exposed to the air.

PROPERTIES AND USES.—Disinfectant, similar to mercuric chloride, but is more soluble and penetrating, and less irritating; dermatology, gynecology, ophthalmology, otology, in solutions—1:1000, 3000, 5000, the weaker for skin disinfection, the stronger for irrigations of the bladder, etc.; 3–4 p. c. solution may be injected into gluteal muscles for syphilis.

ARSENUM (ARSENICUM). ARSENIC.

$As^{iii-v} = 74.9.$

The element arsenic (L. *arsenicum*, fr. Gr. *αρσενικόν*, orpiment; lit. masculine, strong—*i. e.*, powerful poison), official 1850–1880, is distributed widely, but generally in small quantities; occurs as native arsenic (cobaltum or fly-stone), as two sulphides (red orpiment or realgar, As_2S_2, and yellow orpiment, As_2S_3), and as arsenides of various metals (arsenical pyrites or mispickel, FeAsS, cobalt glance, CoS_2,-$CoAs_2$, and tin-white cobalt, $CoAs_2$). The metal may be obtained by heating arsenical pyrites—$FeS_2,FeAs_2$ + heat = 2As + 2FeS. Arsenic being volatile, passes over, condenses, and should be purified by heating with charcoal, as it may contain As_2O_3; thus, $As_2O_3 + 3C = 3CO + 2As$. Metal is a steel-gray, metallic mass, losing lustre by forming a film of oxide, brittle, volatile, sp. gr. 5.73–5.88; used as a fly-poison and in shot (alloy of lead and arsenic); forms two kinds of salts—*arsenous* (lower) and *arsenic* (higher).

Tests for Arsenic Salts: 1. H_2S in acid solution precipitates bright yellow orpiment, As_2S_2, soluble in ammonia water. 2. $AgNO_3$ with ammonia water precipitates in neutral solutions of arsenous acid yellow silver arsenite, Ag_3AsO_3, in arsenic acid solution get reddish-brown precipitate of silver arsenate, Ag_3AsO_4. 3. Cupric sulphate + arsenous acid + ammonia water precipitates Scheele's green—cupric arsenite, $CuHAsO_3$. 4. Marsh's test: Add to arsenic solution Zn + H_2SO_4, the escaping hydrogen gas when ignited deposits brown metallic ring upon cold porcelain, soluble in solution of chlorinated lime (bleaching-powder). 5. Reinsch's test: Add bright copper plate to acid arsenical solution, heat, when it becomes coated with film of metallic arsenic.

Arseni Trioxidum. Arsenic Trioxide, As_2O_3.—(Syn., Arsen. Triox., Arsenous Acid, Arsenous Oxide, White Arsenic, Arsenic, Flowers of Arsenic, Arsenicum Album; Br. Acidum Arseniosum, Arsenious Anhydride; Fr. Acide arsénieux, Arsenic blanc, Fleurs d'Arsenic; Ger. Acidum arsenicosum, Arsenige Säure, Weisser Arsenik.)

Manufacture: This is often a by-product in separating metal from the ores (cobalt, nickel, tin, silver, arsenical iron pyrites) metallurgically, when by roasting it sublimes; it becomes acid only in the presence of water—$2As_2O_3 + 6H_2O = 4H_3AsO_3$. It is a heavy solid—either an opaque, white powder, or irregular masses of two varieties: one amorphous, transparent, colorless like glass; the other crystalline, opaque, white, resembling porcelain; often same piece has opaque, white outer crust enclosing the glassy variety, the latter being converted into the former when exposed to moist air; both odorless, tasteless, slowly soluble in water, the glassy (30) more so than the crystalline (100), slightly soluble in alcohol, ether, freely in glycerin, hydrochloric acid, alkaline solutions; heated to 200° C. (392° F.)—glassy—fuses, sublimes;

crystalline—sublimes without fusing—residue .1 p. c.; contains 99.8 p. c. of pure salt. *Tests:* 1. Heat slowly in dry test-tube—sublimate of octahedral crystals, not yellow (abs. of arsenous sulphide). 2. Heat strongly with charcoal —reduced metallic arsenic deposits on cooler portion of tube as a mirror, soluble in sodium or calcium hypochlorite. 3. Aqueous solution faintly acid; solution in ammonia water, 1 in 10 (gentle heat)—colorless. *Impurities:* Antimony, tin, cadmium, arsenous sulphide. Dose, gr. $\frac{1}{30}$–$\frac{1}{15}$ (.002–.004 Gm.), on full stomach, until puffiness of eyelids or curative effect produced.

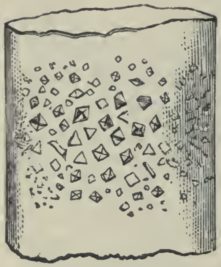


FIG. 466.—Sublimate arsenic trioxide, magnified.

PREPARATIONS.—1. *Liquor Acidi Arsenosi.* Solution of Arsenous Acid. (Syn., Liq. Acid. Arsen., Hydrochloric Solution of Arsenic, Solution of Arsenic Chloride; Br. Liquor Arsenici Hydrochloricus; Fr. Liqueur arsénicale hydrochlorique; Ger. Chlorarseniklösung.)

Manufacture: 1 p. c. Mix in a tared flask diluted hydrochloric acid 5 Gm. with distilled water 25 Gm., add arsenic trioxide 1 Gm., boil until dissolved, cool, add distilled water q. s. 100 Gm., filter. It is a clear, colorless aqueous liquid, odorless, acidulous taste, acid reaction; contains arsenous acid equivalent to .975–1.025 p. c. of arsenic trioxide. *Tests:* 1. With hydrogen sulphide T. S.—lemon-yellow precipitate (arsenic trisulphide), soluble in ammonium carbonate T. S. Dose, ♏iij–5 (.2–.3 Ml. (Cc.)), ter die, diluted.

2. *Liquor Potassii Arsenitis.* Solution of Potassium Arsenite. (Syn., Liq. Pot. Arsen., Fowler's Solution, Liquor Arsenicalis (Fowleri), Arsenical Solution, Kali Arsenicosum Solutum; Fr. Liqueur (Solution) arsenicale de Fowler; Ger. Liquor Kalii arsenicosi, Fowlersche Lösung (Tropfen).)

Manufacture: 1 p. c. Boil arsenic trioxide 1 Gm., potassium bicarbonate 2 Gm., with distilled water 10 Ml. (Cc.) until dissolved, add distilled water q. s. 97 Gm., add compound tincture of lavender 3 Gm., filter. It is a clear, faintly opalescent aqueous liquid (solution), pinkish, slight odor of lavender, alkaline; contains potassium arsenite, corresponding to .975–1.025 p. c. of arsenic trioxide. *Test:* 1. Acidulate strongly 10 Ml. (Cc.) with hydrochloric acid, add equal volume of hydrogen sulphide T. S.—yellow precipitate, soluble in ammonium carbonate T. S. *Impurities:* Arsenate, etc. Should be kept in amber-colored bottles. Dose, ♏iij–5 (.2–.3 Ml. (Cc.)), ter die, diluted.

3. *Arseni Iodidum.* Arsenous Iodide, AsI_3. (Syn., Arsen. Iod., Arsenic Iodide, Arsenici Iodidum, Ioduretum Arseniosum; Fr. Iodure d'Arsenic; Ger. Arsenicum (Arsenum) jodatum, Arsenik Jodur, Arsentrijodid.)

Manufacture: 1, $As_2O_3 + 6HCl$ (hot) $= 2AsCl_3 + 3H_2O$, which by double decomposition with KI gives AsI_3; thus, $2AsCl_3 + 6KI = 2AsI_3 + 6KCl$; 2, $As_2O_3 + 6HI = 2AsI_3 + 3H_2O$; 3, triturate and heat together metallic arsenic 75 parts and iodine 380. It is an orange-red, inodorous, crystalline powder, stable when kept cool and dark, soluble with partial decomposition in water (12), alcohol, chloroform, ether, carbon disulphide; heated on water-bath—loses no iodine, beyond that volatilizes—residue .5 p. c.; warmed with nitric acid—brown vapors of nitrogen oxides, followed by those of iodine (violet); contains 99 p. c. of pure salt. *Tests:* 1. Aqueous solution (colorless, upon standing yellow—decomposing into arsenous, hydriodic acids) + hydrochloric acid + hydrogen sulphide T. S.—lemon-yellow precipitate (arsenous sulphide). 2. Aqueous solution (1 in 20) 5 Ml. (Cc.) + chlorine water 1 Ml. (Cc.)—liberates iodine, solution light reddish-brown; agitate mixture with little chloroform—latter violet. Should be kept cool, dark, in amber-colored, glass-stoppered vials. Dose, gr. $\frac{1}{20}$–$\frac{1}{10}$ (.003–.006 Gm.).

Prep.: 1. *Liquor Arseni et Hydrargyri Iodidi*, 1 p. c.

Unoff. Prep.: Liquor Arsenicalis, Clemens—arsenic trioxide 1, potassium bicarbonate 4, bromine .5, water q. s. 100.

PROPERTIES AND USES.—Arsenic Trioxide—alterative, anaphrodisiac, irritant poison, nervine, tonic; chronic malaria, intermittents, skin diseases (eczema, psoriasis, lepra, prurigo), nervous debility, chorea, chronic rheumatism, gout, constitutional syphilis, frontal neuralgia, hemicrania, obesity, gastralgia, anæmia, spasmodic asthma, amenorrhœa, dysmenorrhœa, menorrhagia, leucorrhœa, diabetes, albuminuria, chronic diarrhœa. Externally—cancers, lupus, epithelial tumors, sarcoma, warts, malignant ulcers, carious teeth. The two liquors are good forms for administration, but it may also be given in tablet, pill, etc. Arsenic Iodide—alterative, irritant poison, used like the acid, but mostly in pill form, and never should be applied on abraded surfaces; Donovan's solution and the ointment ($\frac{1}{2}$–1 p. c.) have merited popularity.

Poisoning: All arsenic compounds produce symptoms resembling those of cholera: constriction and heat of fauces, faintness, nausea, burning abdominal pain and tenderness, thirst, violent retching, vomiting (brown often streaked with blood), bloody stools, tenesmus, strangury, cold skin, small and feeble pulse, spasms, dyspnœa, death in collapse. Wash out stomach, give emetics, follow with recently prepared ferric hydroxide or ferric hydroxide with magnesium oxide, dialyzed iron, to envelop, as well as to form insoluble ferric arsenite, or arsenate, chalk, lime water, demulcents, opiates, stimulants, heat, spirit nitrous ether, remove iron compound with zinc sulphate.

Incompatibles: Salts of iron, silver, copper, ammonium, calcium, magnesium oxide, vegetable astringents.

Synergists: Restoratives, nux vomica, etc.

ANTIMONIUM. ANTIMONY (STIBIUM).

$Sb^{iii-v} = 120.2.$

The element antimony (Gr. ἀντί, against, + *moine*, monk—monk's-bane, poisons monks; or Gr. ἀντί, against, + μόνος, alone—never found alone; or Gr. ἀντί, instead of, + L. *minium*, red lead—women once used it instead of red lead for painting around the eyes; L. *stibium*, Gr. *στίβι*, name of sulphide of antimony), official 1830–1840, has several official compounds, and occurs natively uncombined, also as oxide, oxysulphide, and mostly as sulphide. From this latter the metal is obtained by roasting it into an oxide, then reducing that with charcoal. It is brittle, bluish-white like silver, crystalline structure, sp. gr. 6.7; forms *antimonous* and *antimonic* compounds.

Tests for Antimony Salts: 1. H_2S in acid solution precipitates orange-red antimonous or antimonic sulphide, Sb_2S_3 or Sb_2S_5, soluble in ammonia water. 2. The sulphide dissolved in HCl and thrown into water precipitates white oxychloride. 3. Zinc and iron precipitate antimony as black powder from its solutions, while copper precipitates it as a black metallic film upon itself, which when heated volatilizes the antimony, depositing it as antimonous oxide. 4. Marsh's test; here brown rings are produced on porcelain, as in arsenic, which are insoluble in solution of chlorinated lime (bleaching-powder).

Antimonii et Potassii Tartras. Antimony and Potassium Tartrate, $K(SbO)C_4H_4O_6 + \frac{1}{2}H_2O$.—(Syn., Antim. et Pot. Tart., Antimonyl Potassium Tartrate, Tartrated Antimony, Tartar Emetic; Antimonium Tartarisatum, Tartarus Emeticus, Stibio-kali Tartaricum; Br. Antimonium Tartaratum, Tartarated Antimony; Fr. Tartrate d'Antimoine et de Potasse, Emetique, Tartre stibié; Ger. Tartarus stibiatus, Brechweinstein.)

Manufacture: Antimony oxide 150 Gm. + potassium bitartrate 180 Gm. + water 1.000 Ml. (Cc.), boil 1 hour, crystallize—$Sb_2O_3 + 2KHC_4H_4O_6 = 2K(SbO)C_4H_4O_6,H_2O$. It is in colorless, transparent, rhombic crystals (efflorescing on exposure), white granular powder, odorless, sweet disagreeable metallic taste; soluble in water (12), boiling water (3), glycerin (15), insoluble in alcohol; aqueous solution slightly acid; contains 98.5 p. c. of pure salt. *Tests:* 1. Heated to redness—chars, odor of burning sugar, blackened alkaline residue imparting violet flame. 2. Aqueous solution + few drops of hydrochloric acid + hydrogen sulphide T. S.—orange-red precipitate, soluble in ammonium sulphide T. S. or potassium hydroxide T. S. *Impurities:* Iron, arsenic. Should be kept in well-closed containers. Dose, alterative, gr. $\frac{1}{32}$–$\frac{1}{16}$ (.002–.004 Gm.); diaphoretic, expectorant, gr. $\frac{1}{12}$–$\frac{1}{6}$ (.005–.01 Gm.); nauseating sudorific, gr. $\frac{1}{6}$–$\frac{1}{4}$ (.01–.016 Gm.), every few hours; emetic, gr. $\frac{1}{2}$ (.03 Gm.), repeated every 20 minutes with warm water or chamomile tea until vomiting occurs.

PREPARATIONS.—1. *Mistura Glycyrrhizæ Composita*, $\frac{1}{42}$ p. c. 2. *Syrupus Scillæ Compósitus*, $\frac{1}{5}$ p. c.

Unoff. Preps.: Vinum Antimonii: antimony and potassium tartrate .4 Gm., boiling distilled water 2.5 Ml. (Cc.), sherry wine q. s. 100 Ml. (Cc.), Dose, ♏x–30 (.6–2 Ml. (Cc.)), repeated as desired; as emetic for children, ʒss–1 (2–4 Ml. (Cc.)), repeated every 15 minutes until vomiting occurs.

Properties and Uses.—Sedative, diaphoretic, expectorant, antiphlogistic, emetic, febrile complaints, first stage of bronchitis, pneumonia, pleurisy, acute rheumatism, tonsillitis, mammary abscess, hernia humoralis, ophthalmia, mumps, skin affections (eczema, urticaria, psoriasis), dropsy, salivation, meningitis, epilepsy, chorea, mania, convulsions, mania-à-potu, rigid os uteri, strangulated hernia, dislocations, nævi, varicose veins. Externally—applied in strong solution or ointment causes pustular eruptions like those of smallpox, producing scabs and indelible scars. Antimony Wine—a good form for diaphoresis in fever crisis, febrifuge, expectorant.

Poisoning: Symptoms similar to arsenic, but less marked; have metallic taste, abdominal pain, incessant, retching, præcordial cramps, burning heat, distended epigastrium, colic, frequent watery stools, dry throat, salivation, difficult deglutition, skin cool, clammy, muscles relaxed, pulse feeble, thready, respiration slow, scanty bloody urine, death may be preceded by stupor, mild delirium, or convulsions. Place in horizontal position, lower head, wash out stomach with solution of tannic acid, green tea, or galls, then demulcent drinks, egg-white, milk, warmth, friction, electricity, opium, stimulants; tartar emetic gr. 2–5 (.13–.3 Gm.) have killed.

Incompatibles: Opium, alcohol, cardiac stimulants, antispasmodics, tannin, gallic acid, lead salts.

Synergists: Emetics, cathartics, cardiac depressants.

Allied Salts:

1. *Antimonii Sulphidum. Antimony Sulphide,* Sb_2S_3, official 1820–1900.—This is native antimony sulphide purified by fusion and as free from arsenic as possible; the grayish-black ore, stibnite (Europe, United States), containing galena, iron pyrites, quartz, and heavy spar, is heated in pots, whereby fusible antimony sulphide runs off into earthen vessels to cool. It is in steel-gray masses, metallic lustre, striated, crystalline fracture, forming grayish-black lustreless powder, odorless, tasteless, permanent, soluble in HCl, insoluble in water, alcohol. Dose, freely in veterinary practice.

2. *Antimonii Sulphidum Purificatum. Purified Antimony Sulphide,* Sb_2S_3, official 1820–1900.—Obtained by taking finely powdered antimony sulphide 100 Gm., removing coarser particles by elutriation, and macerating for 5 days the fine subsiding sulphide in ammonia water 50 Ml. (Cc.), agitating frequently to remove any arsenic present, then washing with water and drying. It is a heavy, blackish, lustreless powder, odorless, tasteless, permanent, insoluble in water, alcohol, soluble in HCl with evolution of hydrogen sulphide. *Impurities:* Arsenic, etc. Used only for pharmaceutical purposes, not prescribed internally to any extent. Dose, gr. 10–30 (.6–2 Gm.), in powder or bolus.

3. *Antimonium Sulphuratum. Sulphurated Antimony, Kermes Mineral* chiefly Sb_2S_3, official 1820–1900.—Obtained by boiling 2 hours purified antimony sulphide 100 Gm., solution sodium hydroxide 1200 Ml. (Cc.), distilled water 3000 Ml. (Cc.), stirring frequently, and adding water to preserve volume, strain, drop into it, while hot, diluted

sulphuric acid q. s. to precipitate completely, wash precipitate with hot distilled water, dry, pulverize. It is an amorphous, reddish-brown powder, odorless, tasteless, losing color on exposure, insoluble in water, alcohol. *Impurities:* Calcium, chloride, sulphate. Alterative, diaphoretic, emetic, but an uncertain medicine. Dose, alterative, gr. 1–2 (.06–.13 Gm.), twice daily, in pill; emetic, gr. 5–20 (.3–1.3 Gm.). Plummer's Pills (*Pilulæ Antimonii Compositæ*, U. S. P. 1890), $\frac{3}{5}$ gr. (.036 Gm.), + mild mercurous chloride $\frac{3}{5}$, guaiac $1\frac{1}{5}$, castor oil q. s.; used in secondary syphilis, skin eruptions, and while taking should avoid acids. Dose, 1–3 pills.

4. *Antimonii Oxidum. Antimony Oxide*, Sb_2O_3, official 1820–1900.—Obtained by pouring a solution of antimony chloride into water, thus precipitating the oxychloride, which is to be decomposed by sodium carbonate. It is a heavy, grayish-white powder, odorless, tasteless, permanent, nearly insoluble in water, alcohol, ether, nitric acid, soluble in hydrochloric acid, hot aqueous solutions of tartaric acid or potassium bitartrate. *Impurities:* Iron, copper, lead, arsenic, chloride, sulphate. Seldom used in medicine, although possessing antimonial properties; owing to its limited solubility does not nauseate or vomit very much; constitutes 33 p. c. (+ precipitated calcium phosphate 67) of James' Powder (*Pulvis Antimonialis*, U. S. P. 1890), used as a diaphoretic in febrile conditions. Dose, gr. 2–4 (.13–.26 Gm.).

STANNUM. TIN.

$Sn^{ii\text{-}iv} = 119.$

The element tin (AS. *tin, stean, stan*, a stone; L. *stannum*, found at Cornwall as oxide, tin-stone), official 1830–1860, occurs chiefly as native stannic oxide (tin-stone), SnO_2. The metal is obtained by heating this oxide with carbon—$SnO_2 + 2C = Sn + 2CO$. It is a nearly silver-white metal, very malleable, fusing at 228° C. (440° F.); forms two series of compounds, *stannous* and *stannic;* used in alloys, with mercury to silver mirrors, and to coat sheet iron to yield tin plate; stannous chloride, $SnCl_2$, is a strong deoxidizing agent used to precipitate the metals mercury and gold, and as a mordant in calico-printing.

Tests for Tin Salts: 1. With H_2S in stannous solution get brown stannous sulphide. 2. With H_2S in stannic solution get yellow stannic sulphide, both precipitates being soluble in ammonium sulphide.

AURUM. GOLD.

$Au^{i\text{-}iii} = 197.2.$

The element gold (AS. *geolu, giolo*, yellow; Gr. χλωρός; L. *aurum*, yellowish—*i. e.*, color of the metal), official 1830–1840, usually occurs in the metallic state with other metals, but sometimes as sulphide. It is separated from adhering rock, sand, etc., by washing, its greater specific gravity (19.3) causing it to subside. When pure it is quite soft, so that for general use it is alloyed with harder metals. Jewelers recognize the pure metal as 24 carat (seldom employed), and when mixed with 25 p. c. of copper or silver as 18 carat. It is affected by none of the pure acids, being dissolved only by nitrohydrochloric acid, free chlorine or bromine, and mercury, forming with this latter an amalgam.

Tests for Gold Salts: 1. H_2S precipitates brown auric sulphide, Au_2S_3, soluble in ammonium sulphide. 2. $FeSO_4$ added and set aside soon precipitates metallic gold in dark powder, which by fusion is converted into a metallic button. 3. Stannous chloride precipitates purple (of Cassius).

Auri et Sodii Chloridum. Gold and Sodium Chloride.—(Syn., Aur. et Sod. Chlor., Chloruretum Aurico-sodicum; Fr. Chloraurate de Sodium, Chlorure d'Or et de Sodium; Ger. Auro-natrium Chloratum, Natriumgoldchlorid.)

Manufacture: Dissolve gold (13) in a mixture of nitric acid (16) and hydrochloric acid (48), add water (40), + pure dry sodium chloride (20), evaporate to dryness with constant stirring—(1) $Au_2 + 2HNO_3 + 8HCl = 2HAuCl_4$, or $2(AuCl_3 + HCl) + 2NO + 4H_2O$. (2) $HAuCl_4 + NaCl = NaAuCl_4$ or $(AuCl_3 + NaCl) + HCl$. It is a mixture of equal parts of anhydrous gold chloride, $AuCl_3$, and anhydrous sodium chloride, $NaCl$, representing, when dried, at least 30 p. c. of metallic gold; it is an orange-yellow powder, odorless, saline metallic taste, deliquescent in damp air, soluble in water; alcohol or ether dissolves the gold chloride leaving the sodium chloride. *Tests:* 1. Aqueous solution (1 in 100) slightly acid, + silver nitrate T. S.—white precipitate, insoluble in nitric acid, but soluble in ammonia water. 2. Fragment in non-luminous flame—intensely yellow. *Impurities:* Free hydrochloric acid, metallic substances. Should be kept in well-stoppered, amber-colored vials. Dose, gr. $\frac{1}{20}$–$\frac{1}{4}$ (.003–.016 Gm.); supposed to be an important agent in the "Keeley cure," associated with hypodermics of atropine, strychnine, etc.

PREPARATION.—(Unoff.): *Liquor Auri et Arseni Bromidi*—arsenic trioxide .25 Gm., brom. auric acid .325, bromine .4, dist. water q. s. 100. Dose, ♏iij–5 (.2–.3 Ml. (Cc.)).

PROPERTIES AND USES.—Action similar to that of mercury, used for syphilis, scrofula, sclerosis of the spine, liver, and kidneys, hypochondriasis, asthma, dysmenorrhœa, migraine, epilepsy, chorea, hysteria, consumption, habitual inebriety. Externally—caustic, like $AgNO_3$, for lupoid, cancerous, and other ulcers. In addition to the double chloride, the bromide, iodide, and oxide also are used in doses of gr. $\frac{1}{20}$–$\frac{1}{4}$ (.003–.016 Gm.), after meals; also the powdered metal may be given in doses gr. $\frac{1}{6}$–1 (.01–.06 Gm.).

PLATINUM.

$Pt^{ii\text{-}iv} = 195.2.$

The element platinum (Sp. *platina,* dim. of *plata,* plate, silver—the two metals resemble in appearance), like gold, occurs mostly in the free state and in combination with iridium, osmium, palladium, rhodium, ruthenium, etc., metals resembling it; also in ores containing gold, lead, iron, silver; comes mainly from Ural Mountains and California. It is silvery white, soft like copper, malleable, ductile, possesses high fusing-point and great resistance to chemicals, soluble in nitrohydrochloric or nitrohydrobromic acid, good conductor of heat and electricity, sp. gr. 21.5; forms two series of compounds—*platinous,* $PtCl_2$, and *platinic,* $PtCl_4$.

Platini Chloridum. Platinic Chloride, $PtCl_4,5H_2O$.—(Syn., Fr. Perchlorure de Platine; Ger. Platinchlorid.)

Manufacture: Platinum 3 parts + hydrochloric acid 16 + nitric acid 7, evaporate nearly to dryness, redissolve in HCl, heat to expel HNO_3, evaporate to dryness; contains 46 p. c. of platinum.

PREPARATION.—*Platinic Chloride Test Solution:* Chloroplatinic acid, $H_2PtCl_6,6H_2O$, 2.6 Gm. dissolved in 20 Ml. (Cc.) distilled water.

PROPERTIES AND USES.—Seldom used in medicine, although the chloride has been employed with good results in constitutional syphilis in doses gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.); the injection (1 p. c.) has been effective in leucorrhœa, gleet, indolent ulcers.

PART IV.

ORGANIC CARBON COMPOUNDS.

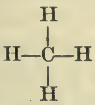
While the number of official preparations made from organic substances is small at present compared with the many that have gained medical favor, and while those accepted by the *U. S. Pharmacopœia* are most important and universally employed, yet it has been deemed wise to include here additionally a few that are scarcely secondary, and which may have a future recognition. So many, built artificially and synthetically, are but reproductions in strength, effect, medicinal properties, etc., of natural plant-products, that we reasonably may expect a time when many such will replace, to a great extent, those from all other sources. As materia medica products are either inorganic or organic, and as the former comprise two great series: metals and metalloids, so the latter has two distinctive series: fatty and aromatic, consequently in this relationship-sequence they will be considered.

For a long time the term organic medicines was applied only to those agents taken directly from plants or animals—from a source built up of manifold varying organs in which alone was supposed to reside "vital force," by which all substances only could be created. We no longer hold tacitly to such restriction, because these very substances often are reproduced by a direct combination of the component elements or from apparent inorganic material which once was organic in nature.

Organic carbon compounds must contain, however, carbon and hydrogen, also frequently oxygen, nitrogen, sulphur. Such elements so differ from each other in chemical and physical properties, while their combining quantities are so unrestricted, that they unite in varying proportions to yield many hundred substances, each differing somewhat from the other.

Carbon, being quadrivalent, is considered the graphical centre around which the other elements are arranged—linked as it were by a bond dependent, as to strength and degree, upon each element's atomic valence. The grouping of these carbon atoms in a molecule is quite different in the two organic series.

I. Fatty Series: Derivatives of methane, CH_4, and are linked so as to form an open chain in which the end carbon atoms are not equivalent to the others:



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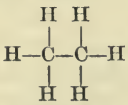
Methane, CH_4



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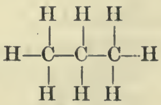
Ethane, C_2H_6



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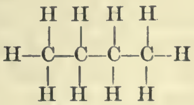
Propane, C_3H_8



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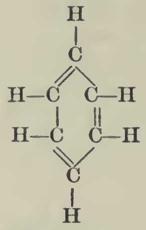
Butane, C_4H_{10}

II. Aromatic Series: Derivatives of benzene (benzol), C_6H_6, and are linked to form a close chain in which every carbon atom is the equivalent of each other. This chain (skeleton) has been assumed from the fact that as soon as 6 or more carbon atoms come together they tend to so unite as to form stable and permanent compounds into which only definite amounts of other elements can be introduced.



Benzene, C_6H_6

Thus benzene takes up 2–4–6 atoms of hydrogen, chlorine, bromine, and under the prolonged action of HI becomes C_6H_{12}, and no more H can be imparted even if the action be continued indefinitely, whereas if carbon atoms were in open chain we would get C_6H_{14}, etc. Then, again, when the hexa-chloride or bromide of benzene is formed, each refuses to take up any more of either element, thus showing roundness or entireness in saturation and composition.

I. FATTY SERIES.

I. Hydrocarbons.

These compounds contain the elements carbon and hydrogen in various proportions, are mostly of vegetable origin, many being obtained by destructive distillation and decomposition of organic matter, and all have different boiling-points, by which it is possible to isolate them when carefully distilled fractionally. They are either gases, liquids, or solids, according to the number of carbon atoms in the molecule: 1–4—gas, 4–10–12—liquid, and beyond this—solid; they can all be volatilized without decomposition, are colorless, usually with characteristic odor, neutral, soluble in alcohol, ether, carbon disulphide, insoluble in water, oxidize by exposure, the liquids often becoming solids.

Benzinum Purificatum. Purified Petroleum Benzin, $C_5H_{12}+C_6H_{14}+$.—(Syn., Benzin. Purif., Petroleum Ether; Fr. Ether de Pétrole purifié; Ger. Gereinigter Petroläther.)

Manufacture: Purified petroleum benzin (*benz*(oic)+*in*—odor somewhat benzoin-like) is a purified distillate from American petroleum consisting of hydrocarbons, chiefly of the marsh-gas series, $C_5H_{12}+C_6H_{14}+$, and may be obtained by mixing sulphuric acid (6 Ml. (Cc.)) and water (55), adding when cold potassium permanganate (.8 Gm.)

and, after it is dissolved, petroleum benzin (100 Ml. (Cc.)) in 4 portions, shaking after each; let stand 24 hours, shaking frequently, decant petroleum benzin and add to it potassium permanganate (.2 Gm.) dissolved in water (24 Ml. (Cc.)) containing sodium hydroxide (.2 Gm.), agitate frequently, repeat washing with water, decant purified petroleum benzin. It is a clear, colorless, non-fluorescent, volatile liquid, ethereal, petroleum-like odor, neutral, highly inflammable, vapor (mixed with air) explosive, insoluble in water, freely soluble in alcohol, miscible with ether, chloroform, benzene, volatile or fixed oils (except castor oil), sp. gr. 0.650, distils at 40–80° C. (104–176° F.). *Tests:* 1. Evaporate from filter paper 10 Ml. (Cc.)—no greasy stain, no disagreeable sulphuretted odor. 2. Evaporate 50 Ml. (Cc.)—residue .0015 Gm. *Impurities:* Benzene, pyrogenous products, sulphur compounds—which the process is intended to remove. Should be kept carefully cool, remote from fire, in well-closed containers. Dose, ♏x–20 (.6–1.3 Ml. (Cc.)), emulsion, capsule, on sugar.

Allied Products:

1. *Benzinum. Petroleum Benzin,* $C_5H_{12} + C_6H_{14}+$, official 1880–1910. —Obtained by subjecting crude petroleum to fractional distillation, when benzin (naphtha), illuminating oils, and a residuum largely composed of paraffin are produced—that part collected at 45–60° C. (113–140° F.) being the once official product. It is a transparent, colorless, diffusible liquid, strong characteristic odor of petroleum, but less disagreeable, corresponding to tests and reactions as above.

PROPERTIES AND USES. — Internally — vermifuge; Externally — sedative, anæsthetic, solvent, tapeworm, scabies, prurigo, herpes, favus, sycosis, rheumatism, neuralgia, to relieve itching in urticària, whooping-cough. Like creosote and phenol (carbolic acid) to restrain fermentation in dyspepsia. Good solvent for fats, volatile oils, resins, caoutchouc, alkaloids, etc.

Petrolatum Liquidum. Liquid Petrolatum.—(Syn., Petrolat. Liq., Liquid Paraffin, Mineral Oil, Liquid (Cosmoline) Vaseline; Br. Paraffinum Liquidum, Liquid Paraffin; Fr. Huile de Paraffine; Ger. Flüssiges Paraffin, Paraffinöl.)

Manufacture: Liquid petrolatum (L. *petra*; Gr. πέτρα, rock, + L. *oleum;* Gr. ἔλαιον, oil—rock oil) is a mixture of liquid hydrocarbons, chiefly of the methane series, obtained by distilling off most of the lighter and more volatile portions from petroleum (a substance found in wells, on surface of streams, and oozing from the ground in Pennsylvania, New York, Ohio, etc.), and purifying the liquid residue—the portion going over at 330–390° C. (626–734° F.) being treated with sulphuric acid, then with caustic alkali, filtered (hot) through animal charcoal, cooled to remove solid paraffins (which crystallize out), collecting and reserving that fraction distilling above 360° C. (626° F.). There are two varieties: 1. *Heavy Liquid Petrolatum*—viscosity 3.1, sp. gr. 0.828–0.905, at 10° C. (50° F.) not more than opalescent (abs. of solid paraffins); 2. *Light Liquid Petrolatum*—viscosity 3, sp.

gr. 0.828–0.905; at 10° C. (50° F.) not more than opalescent (abs. of solid paraffins). Each is a colorless, transparent, oily liquid, free, or nearly free, from fluorescence, odorless, and tasteless when cold, faint petroleum odor when heated; soluble in ether, chloroform, petroleum, benzin, fixed or volatile oils, insoluble in water, alcohol; dissolves camphor, menthol, thymol, and many other substances. *Impurities:* Acids, sulphur compounds, carbonizable substances, solid paraffins. Should be kept dark, in well-closed containers.

Preparations.—(Unoff.): *Petroxolinum Liquidum,* 50 p. c., + oleic acid 28, stronger ammonia water 5, alcohol 15, oil of lavender 2. *Petroxolinum Spissum,* 20 p. c., + white wax 35, oleic acid 32, +.

Petrolatum. Petrolatum, $C_{16}H_{34}$ +.—(Syn., Petrolat., Petrolatum Ointment, Petroleum Jelly, Petrolatum (Mollé) Spissum, Vaseline, Cosmoline, Soft Paraffin; Fr. Petroleine; Ger. Unguentum Paraffinum, Paraffin (salbe) butter.)

Manufacture: A purified mixture of semi-solid hydrocarbons, chiefly of the methane series, obtained by distilling off the lighter and more volatile portions from petroleum, and purifying the residue. It is an unctuous mass, yellowish, light amber, slight fluorescence, even when melted, transparent in thin layers, completely amorphous, free, or nearly free from odor and taste; soluble in ether, chloroform, carbon disulphide, oil of turpentine, petroleum benzin, benzene, most fixed and volatile oils, insoluble in water, almost insoluble in cold or hot alcohol, or cold dehydrated alcohol, sp. gr. 0.820–0.865, melts at 38–54° C. (100–129° F.). *Tests:* 1. 2 Gm. heated in open dish over flame volatilizes without acrid odor; incinerate—ash .05 p. c. 2. Melt, shake with equal vol. of hot distilled water—latter neutral (abs. of acids, alkalies). 3. Digest 10 Gm. for half an hour at 100° C. (212° F.) with sodium hydroxide 10 Gm. + distilled water 50 Ml. (Cc.), separate and supersaturate aqueous layer with sulphuric acid —no oily or solid substance separates (abs. of fixed oils, fats, rosin). *Impurities:* Acids, alkalies, fixed oils, fats, rosin.

Preparations.—1. *Unguentum Hydrargyri Dilutum,* 40 p. c. 2. *Unguentum Hydrargyri Oxidi Flavi,* 40 p. c.

Unoff. Preps.: Emulsum Petrolati, 22.5 p. c., + expressed oil of almond 22.5, acacia 12.5, syrup 10, tinct. of lemon peel 1.5, water q. s. 100. *Unguentum Hydrargyri Oxidi Rubri,* 40 p. c., +. *Unguentum Resorcinolis Compositum,* 25 p. c., +.

Petrolatum Album. White Petrolatum.—(Syn., Petrolat. Alb., White Petroleum Jelly, Paraffinum Album, White (Vaseline, Cosmoline) Paraffin, Refined (Paraffin) Petrolatum; Fr. Vaseline blanc; Ger. Weisses Vaselin.)

Manufacture: Petrolatum wholly or nearly decolorized, being a colorless mixture of hydrocarbons, chiefly of the methane series, obtained by distilling off the lighter and more volatile portions from petroleum and purifying the residue. It is a white, faintly yellowish unctuous mass, transparent in thin layers even after cooling to 0° C. (32° F.), completely amorphous, otherwise similar to petrolatum.

Preparations.—1. *Unguentum Acidi Borici,* 85 p. c. 2. *Unguentum Hydrargyri Ammoniati,* 50 p. c.

Unoff. Preps.: Ceratum Camphoræ, 15 p. c. *Ceratum Plumbi Subacetatis,* 38 p. c. *Unguentum Zinci Stearatis,* 50 p. c.

Properties and Uses.—Petrolatum in its three forms is a bland, neutral, protective dressing and a substitute for fatty substances in ointments; large doses, mild laxative, soothing internal irritation and inflammation. Liquid form largely used in spray, being a good vehicle and solvent for many medicinal agents, applicable to mucous membranes of bronchi, larynx, nose, throat; also used for lubricating purposes. None becomes rancid, and all are absolutely non-irritating. Workmen employed in its manufacture never are troubled with chronic bronchitis or phthisis.

Allied Products:

1. *Bitumen. Bitumen,* official 1820–1830.—This was the crude petroleum (L. *petra,* rock, + *oleum*) as found in various places (North America, England, Scotland, West Indies) under the names naphtha, petroleum, oleum gabearium, Seneca oil, Barbadoes tar (naphtha), Trinidad pitch, etc. Formerly was used as we now use petroleum; upon distillation have residue left in still, termed solid bitumen or asphaltum.

2. *Rhigolene.*—Obtained from petroleum by redistillation until a liquid is secured boiling at 18° C. (64.4° F.). It evaporates more rapidly than all known liquids (except cymogene, which boils at 0° C. (32° F.)), and when atomized gives a temperature of —9° C. (15.8° F.). Used to produce local numbness, or freezing, for minor operations by cautery, etc.

Paraffinum. Paraffin. — (Syn., Paraff.; Br. Paraffinum Durum, Hard Paraffin; Fr. Paraffine; Ger. Paraffinum solidum, Ceresin, Festes Paraffin, Gereinigtes Erdwachs.)

Manufacture: This is a purified mixture of solid hydrocarbons, chiefly of the methane series, usually obtained by chilling and pressing the distillates from petroleum having high boiling-points, and purifying the solid press cake so obtained. Paraffins are formed from fats and other organic compounds, but chiefly result from destructive distillation of bituminous shale, etc., found as natural constituent in petroleum and in minerals known as mineral wax, earth-wax, and ozokerite. The tarry oil of shale is distilled, giving a residue of coke and asphalt, treat distillate with sulphuric acid, then with sodium hydroxide (to remove olefins, phenols), wash product, redistil, and after recovery of lighter hydrocarbons and lubricating oils, the remaining thick oil upon cooling separates paraffin; dissolve crude paraffin in petroleum or naphtha, again separate by refrigeration and pressure, melt, decolorize by filtering through animal charcoal. It is a colorless, white, more or less translucent mass, crystalline when separating from solution, slightly greasy to the touch, odorless, tasteless, soluble in ether, petroleum benzin, benzene, carbon disulphide, volatile oils, most warm fixed oils, slightly in dehydrated alcohol, insoluble in water or alcohol, sp. gr. 0.900, melts at 54° C. (129° F.), strongly heated ignites, burning with luminous flame depositing carbon; contains chiefly $C_{24}H_{50}$ and $C_{27}H_{56}$. *Tests:* 1. Heat .5 Gm. with equal weight of sulphur—mixture black from separated carbon, and hydrogen sulphide gas is evolved. 2. Not acted upon or colored by strong sulphuric or nitric acid in the cold; when melted and shaken with an equal volume of hot alcohol—latter does not redden moistened blue litmus paper (abs. of acids).

Preparation.—1. *Unguentum Acidi Borici*, 5 p. c.

Properties and Uses.—Protective, emollient; preserves lemons, meat, etc., when coated with thin film, makes paper impervious to moisture, lubricator, chewing gum, to adulterate candies, chocolate, coat pills, bottles, jars, boxes, to correct deformities, inject into tissues, ointments, candles.

II. Alcohols.

These are hydrocarbon residues in combination with hydroxyl, OH, or hydrocarbons in which one or more hydrogen atoms have been replaced by hydroxyl, if 1 = monatomic, 2 = diatomic, 3 = triatomic, 4 = tetratomic alcohols, etc. They are hydroxides of the organic radicals or residues, as thus shown:

CH_3OH—	C_2H_5OH—	C_3H_7OH—	C_4H_9OH—	$C_5H_{11}OH$—	$C_3H_5 3OH$.
Methyl Alcohol.	Ethyl Alcohol.	Propyl Alcohol.	Butyl Alcohol.	Amyl Alcohol.	Glycerin.

Here methane, CH_4, is converted into methyl, CH_3, which combines with hydroxyl, OH, to form methyl alcohol. Ethane, C_2H_6, is converted into ethyl, C_2H_5, which unites with OH to form ethyl alcohol, etc.

1. Monatomic Alcohols.

Alcohol. **Alcohol**, C_2H_5OH.—(Syn., Alcohol Vini, Spirit of Wine, Common (Ethyl) Alcohol, Spiritus Vini Rectificatissimus; Br. Spiritus Rectificatus, Rectified Spirit; Fr. Alcool, Esprit de Vin; Ger. Spiritus, (Rectificirter) Weingeist.) A liquid composed of 92.3 p. c. by weight, or 94.9 p. c. by volume, of ethyl alcohol, C_2H_5OH, and 7.7 p. c. by weight of water.

Manufacture: 1. From ethene, C_2H_4, by adding the elements of water, which can be done by shaking with sulphuric acid—(1) $C_2H_4 + H_2SO_4 = C_2H_5HSO_4$. (2) $C_2H_5HSO_4 + H_2O +$ distillation $= C_2H_5OH + H_2SO_4$. 2. Obtained on a large scale by the mashing process—fermenting (with yeast, etc.) certain weak saccharine solutions containing grape-sugar or glucose—$C_6H_{12}O_6 +$ ferment $= 2C_2H_5OH + 2CO_2$. In actual practice, grain, such as barley, corn, rye, wheat, is malted or germinated. Here the starch is acted on by the contained ferment (diastase), converting it into maltodextrin and maltose, and finally into dextrose, apparently by the simple appropriation of water—$3C_6H_{10}O_5$ (starch) $+ H_2O = C_6H_{10}O_5$ (dextrin) $+ C_{12}H_{22}O_{11}$ (maltose)

$C_6H_{10}O_5 + C_{12}H_{22}O_{11} + H_2O = 3C_6H_{12}O_6$ (dextrose). This will be transformed into other products if germination be allowed to go on, but prior to that resulting (when acrospire is about one-third the length of the grain, and maximum amount of diastase is present), the sprouted grain is roasted, ground, then infused in warm water, thus forming *mash*, and the yielded dextrose solution, *wort*, fermented by yeast. This fermented liquid, *wash*, contains water, fusel oil, glycerin, succinic acid, and never more than 14 p. c. alcohol, as the yeast plant is unable to live in a fluid of greater strength. By first distillation get *low wine* (about 20 p. c. alcohol), and by second distillation a liquid much richer in alcohol—*raw whisky*, which treated with charcoal, redistilled and vapors passed through a series of condensers gives a product free from water and other impurities—the final traces of these being removed by redistillation over sodium manganate, anhydrous sodium acetate (2 p. c. for odor), and freshly burned lime. It is a transparent, colorless, mobile, volatile liquid; slight characteristic odor, burning taste; miscible with water, ether, chloroform in all proportions without cloudiness, neutral; sp. gr. 0.816; boils at 78° C. (178° F.). *Tests:* 1. Inflammable—burning with bluish smokeless flame. 2. Evaporate 50 Ml. (Cc.)—residue .002 Gm. *Impurities:* Fusel oil constituents, aldehyde, amyl alcohol, methyl alcohol, acetone, oak tannin, non-volatile carbonizable organic substances. Should be kept cool, remote from fire, in well-closed containers.

PREPARATIONS.—1. *Alcohol Dilutum.* Diluted Alcohol. (Syn., Alcohol Dil., Proof Spirit; Fr. Alcool dilué; Ger. Spiritus dilutus (Vini Rectificatus), Verdünnter Weingeist.) A liquid containing 41–42 p. c. by weight, or 48.4–49.5 p. c. by volume, of C_2H_5OH.

Manufacture: 1. Alcohol 50 Ml. (Cc.), distilled water 50 Ml. (Cc.), when mixed and cooled will measure 97 Ml. (Cc.). 2. Alcohol 40.8 Gm., distilled water 50 Gm. It has sp. gr. 0.936; should respond to alcohol tests, and be kept cool, remote from fire, in well-closed containers.

2. *Alcohol Dehydratum.* Dehydrated Alcohol. (Syn., Alcohol Dehyd., Alcohol Absolutum, U. S. P. 1900, Alcohol Ethylicum; Fr. Alcool Absolu; Ger. Alcohol absolutus, Absolutor Alkohol.) A liquid containing 99 p. c. by weight of C_2H_5OH.

Manufacture: Percolate the strongest and purest alcohol through recently burned lime, out of contact with air, redistil the percolate in vacuo. It is a transparent, colorless, mobile, volatile liquid; characteristic odor; burning taste, very hygroscopic, sp. gr. 0.798. *Tests:* 1. Shake 10 Ml. (Cc.) with powdered anhydrous copper sulphate .5 Gm.—latter not blue (abs. of water). Should respond to alcohol tests, and be kept cool, remote from fire, in well-closed containers.

Allied Products:

1. *Spiritus Frumenti. Whisky,* official 1860–1910.—An alcoholic liquid obtained by distilling the mash of fermented grain—such as Indian corn, rye, wheat and barley, or their mixtures, sometimes oats and potatoes. The infusion is fermented as for alcohol, by which

the saccharine matter and indirectly starch are converted into alcohol and CO_2; this resulting liquid from the mash is distilled, yielding low wines, which are in turn distilled, giving a stronger and purer spirit with less fusel oil, known as raw corn-spirit or whisky. This is kept in barrels for several years, at least four, to mellow and improve in flavor by formation of compound ethers, then colored, diluted if necessary, and placed upon the market. It is an amber-colored liquid, distinctive odor and taste, sp. gr. 0.924–0.945, corresponding to alcoholic strength 44–50 p. c. by weight, or 50–58 p. c. by volume. *Impurities:* Fusel oil from grain, added sugar, glycerin, aromatic substances, oak-tannin from casks, free acid.

2. *Spiritus Vini Gallici. Brandy,* official 1850–1910.—An alcoholic liquid obtained by distilling the fermented, unmodified juice of fresh grapes, and at least 4 years old. When the pure juices of fruits are fermented and the resulting liquid from the *marc* distilled, the distillate is brandy; hence we may have a number of brandies named according to the fruit used, as grape, apple, peach, etc. It is that of grapes, however, which was once official and still recognized throughout the world under the name of brandy. The best is from the grape wines of France, produced in the districts of Cognac, Armagnac, Bordeaux, Rochelle, etc. Most excellent brands are distilled also in Spain, Portugal, Germany, and United States—Catawba and California being considered our best. Brandy is a pale amber-colored liquid, distinctive odor and taste, sp. gr. 0.925–0.941, corresponding to an alcoholic strength of 39–47 p. c. by weight, or 46–55 p. c. by volume. *Impurities:* Fusel oil from grain or potato spirit, added sugar, glycerin, aromatic substances, oak-tannin from casks, free acid.

3. *Vinum Album. White Wine,* official 1880–1910. See page 391. *Vinum Xericum. Sherry Wine,* official 1850–1880.—Formerly selected as the representative to be used whenever white wine was desired; sp. gr. 0.978–0.995; alcoholic strength 18–22 p. c.

4. *Vinum Rubrum. Red Wine,* official 1880–1910. See page 391. *Vinum Portense. Port Wine,* official 1850–1910.—Formerly selected as the representative to be used whenever red wine was desired; it is from the grape cultivated near the river Douro, in Portugal, being exported from Oporto; alcoholic strength 18–22 p. c.

5. *Alcohol Amylicum.. Amyl (Amylic) Alcohol,* $C_5H_{11}OH$, official 1860–1880.—This is produced during the alcoholic fermentation of grain, and especially potatoes, the great bulk passing over with the last portions of the first distillation which are milky and contain additionally varying amounts of ethyl (20–30 p. c.), propyl and isobutyl alcohols, water, pyridin, furfurol, ethers, etc., differing with the fusel oil source. To purify wash with strong solution sodium chloride or calcium chloride, distil washed residuum, collecting that coming over at 128–131° C. (262–268° F.). It is an oily colorless liquid, penetrating oppressive odor, burning acrid taste, sp. gr. 0.818, boils at 132° C. (269° F.), congeals at —134° C. (—209° F.), soluble in alcohol, insoluble in water. Does not take fire like alcohol, requiring heating

to 55° C. (131° F.) before igniting. When treated with an oxidizing agent 2 atoms of H are replaced by 1 of O, giving $C_5H_{10}O_2$, which is amylic or valeric (valerianic) acid, this being the method of obtaining nearly all of this acid.

Properties and Uses.—Alcohol in its various forms is stimulant, depressant, diuretic, astringent, disinfectant, antipyretic, rubefacient, diaphoretic; stimulates heart muscle, causing rapid and strong beats, dilates peripheral bloodvessels, stimulates brain by increasing blood supply; before meals improves appetite, during meals retards digestion by checking flow of gastric juice and increasing secretion of mucus, moderate amounts serve as a food, being oxidized during circulation; lessens waste of tissues. It is rapidly absorbed and eliminated by kidneys, lungs, skin, and liver. Internally—debility, typhoid and other low fevers, pyæmia, pneumonia, erysipelas, after shocks, fatigue, prolonged sickness, syncope, delirium, febrile stupor, tremor, eruptive and relapsing fevers, consumption, delirium tremens, poisoning by serpents, narcotics, etc., tetanus, epilepsy, reflex convulsions (as in dentition), vomiting of pregnancy, neuralgia. Externally—wounds, abscesses, aneurisms, gangrenous and other ulcers, nipple fissures, sore feet, bruises, sprains, paralyzed limbs, nasal polypi, soft tumors, varicocele. As an anæsthetic to diminish shock of surgical operation, to facilitate reduction of dislocation. Alcohol—in pharmacy is quite indispensible by reason of its extractive and preservative powers; also useful to preserve animal tissue, and in the arts. Whisky—is an excellent stimulant, does not constipate like brandy, and owing to its cheapness and purity is preferred generally. Used also as an antiseptic in wounds, ulcers, etc. Brandy—on the other hand, is more grateful to the stomach, more palatable, and less apt than whisky, gin, etc., to cause liver or kidney diseases. It is much used in low fevers, with milk, flavored to the patient's taste. White and Red Wines—tonic in convalescence, excessive discharge of blood, prolonged suppuration, etc. Amyl alcohol—poisonous, and should be given cautiously as a nervous stimulant, in phthisis; chiefly used to make amyl nitrite, fruit-essences (ether), sodium valerate, and valeric acid.

Poisoning: Have confused mind, giddiness, muscular relaxation, hallucinations, stupor, coma, rapid, weak pulse, cool, moist skin, dilated pupils, noisy breathing, livid lips; usually can arouse for a short time. Continued abuse may produce chronic gastritis, liver cirrhosis, gout, peripheral neuritis, delirium tremens, mania, Bright's disease, predisposes to phthisis, and lessens resistence to pneumonia and surgical operations. When acute, empty stomach by mustard, hypodermic apomorphine, or pump, washing it out well with strong warm coffee, plenty fresh air, inhale ammonia, give aromatic spirit of ammonia, coffee, capsicum, vinegar, hot milk, apply cold water to head, warmth to body and extremities, electricity. In delirium may quiet with hydrated chloral, potassium bromide, opium, follow with digitalis, strychnine, possibly gastric sedatives (bismuth subnitrate, phenol (carbolic acid), etc.).

2. TRIATOMIC ALCOHOLS.

Glycerinum. Glycerin, $C_3H_5(OH)_3$.—(Syn., Glycerol, Glycerine, Glycerina; Fr. Glycérine; Ger. Glyceryloxyhydrate, Oelsüss, Scheeleches Süss.)

Manufacture: Glycerin (Gr. γλυκερός, γλυκύς, sweet—its taste) is obtained by the hydrolysis of vegetable or animal fats, or fixed oils, and purified by distillation; when these are acted upon (decomposed) by an alkali, this latter unites with the fatty acids, forming soap, and liberates glycerin:

$$\underset{\substack{\text{Glyceryl Oleate}\\\text{(Olive Oil).}}}{C_3H_53C_{18}H_{33}O_2} + 3NaOH = \underset{\substack{\text{Glyceryl}\\\text{Hydroxide}\\\text{(Glycerin).}}}{C_3H_5(OH)_3} + \underset{\substack{\text{Sodium Oleate.}\\\text{(Hard Soap).}}}{3NaC_{18}H_{33}O_2.}$$

It is a clear, colorless, thick, syrupy liquid, slight, characteristic odor; sweet taste, with the sensation of warmth in the mouth; absorbs moisture on exposure; miscible with water, alcohol; insoluble in chloroform, ether, benzene, petroleum benzin, carbon disulphide, fixed or volatile oils; aqueous solution neutral, sp. gr. 1.249; contains 95 p. c. of the trihydric alcohol, $C_3H_5(OH)_3$. *Tests:* 1. Does not volatilize appreciably from weak aqueous solution; when of 70–100 p. c. strength, rapidly volatilizes at 100° C. (212° F.). 2. Heat a few drops with .5 Gm. of potassium bisulphate—pungent vapors of acrolein evolved. *Impurities:* Heavy metals, arsenic, ammonium compounds, acrolein, glucose, fatty acids and esters, sulphate, oxalic acid, readily carbonizable substances. Dose, ♏x–60 (.6–4 Ml. (Cc.)).

PREPARATION.—1. *Suppositoria Glycerini.* Suppositories of Glycerin. (Syn., Supp. Glycerin.; Br. Glycerin Suppositories; Fr. Suppositoires de Glycérin; Ger. Glycerin Suppositorien (Stuhlzäpfchen).)

Manufacture: Dissolve monohydrated sodium carbonate .5 Gm. in water 5 Ml. (Cc.), add it to glycerin 30 Gm., in suitable vessel well down in the boiling water of water-bath and contents protected from steam of bath, add stearic acid 2 Gm., heat for 15 minutes, until all carbon dioxide evolved and liquid clear; pour into 10 molds, cool. Should be kept cool, in tightly-stoppered glass vessels.

PROPERTIES AND USES.—Irritant, laxative, solvent, emollient when diluted. Externally—skin diseases (eczema, herpes, lepra, pityriasis, psoriasis, lichen, prurigo); in lotion for incrusted lupus, chapped skin, excoriated surfaces, fissures, of anus and nipple, wounds, boils, carbuncles, abscesses, coryza, pharyngitis, otorrhœa; allays itching, dryness of mouth, deafness. Internally—phthisis, diabetes, typhoid fever, constipation, in enemas or suppositories, ascarides, dysentery, hemorrhoids, leucorrhœa. In pharmacy as a solvent (iodine, bromine, tannin, alkaloids, salicin, alkalies, etc.), vehicle, excipient, preservative, to keep extracts soft and from molding, etc. Suppositories—for constipation, acting as mechanical irritants; 1 applied night and morning.

Spiritus Glycerylis Nitratis. Spirit of Glyceryl Trinitrate.—(Syn., Sp. Glyceryl. Nit., Spirit of Glonoin, Spirit of Nitroglycerin; Br. Liquor Trinitrini, Solution of Trinitrin; Propenyl Trinitrate.)

Manufacture: Gradually add dehydrated glycerin (7) to well-cooled solution of sodium nitrate (20) in sulphuric acid (40); or slowly add glycerin (1) to a mixture of nitric acid 1 and sulphuric acid 2 (7), at below 27° C. (80° F.), the radical NO replacing hydrogen in the glycerin—$C_3H_5(OH)_3 + 3HNO_3 = C_3H_5(NO_3)_3 + 3H_2O$; in either case the glyceryl trinitrate separates as an oily layer, which is washed with water and dilute sodium hydroxide solution to remove acid. It is an alcoholic solution containing 1–1.1 p. c. of glyceryl trinitrate, $C_3H_5(NO_3)_3$, clear, colorless, neutral, odor and taste of alcohol (must use caution in tasting, as a small quantity produces violent headache, as it does also when freely applied to the skin), sp. gr. 0.814–0.820. *Tests:* 1. Heat on water-bath 10 Ml. (Cc.) with 1 Ml. (Cc.) of potassium hydroxide T. S. until alcohol evaporated, heat portion of residue with .5 Gm. of potassium bisulphate—pungent odor of acrolein; dissolve remaining portion in 2 Ml. (Cc.) of acidulated (H_2SO_4) distilled water, + few drops of diphenylamine T. S., pour solution upon 2 Ml. (Cc.) of sulphuric acid so as to form a separate layer—dark blue color at zone of contact. 2. Mix 10 Ml. (Cc.) with 11 Ml. (Cc.) of distilled water—clear solution; add distilled water 2 Ml. (Cc.)—turbid mixture. Should be kept cool, dark, remote from fire in well-stoppered bottles, and must be dispensed, handled, packed, transported, and stored with great care, as dangerous explosions may result when spilled and alcohol evaporated—should such occur pour over it at once a solution of potassium hydroxide to effect partial decomposition. Dose, ♏j–3 (.06–.2 Ml. (Cc.)), mouth or hypodermically.

PREPARATIONS.—(Unoff.): *Pilulæ Glycerylis Nitratis:* spirit of glyceryl trinitrate 6.5 Gm., althæa 6.5, confection of rose q. s. 100 pills. *Tabellæ Trinitrini* (Br.), each contains trinitroglycerin, $\frac{1}{130}$ gr. (.0005 Gm.), dose, 1–2 tablets.

PROPERTIES AND USES.—Like amyl nitrite (or any nitrite), except that its action is not quite so prompt, but is more persistent. Angina pectoris, asthma, convulsions, tetanus, collapse, illuminating-gas, strychnine- and chloroform-poisoning, cardiac stimulant. If taken early, often wards off attacks of cardiac pain and epileptic seizures. It is thought that in undergoing alkaline decomposition in the system the nitrite is formed, which yields nascent nitrous acid.

III. Aldehydes.

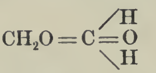
1. HALOGEN DERIVATIVES.

Aldehydes are obtained from alcohol by removing 2 atoms of hydrogen, hence name *al*(cohol) + *dehyd*(rogenatus)—*de*, from, + hydrogen—*i. e.*, alcohol deprived of hydrogen. They are chemically between alcohols and acids, and may be considered unsaturated hydrocarbons attached to COH, thus:

$$(1)\ \underset{\text{Ethane.}}{C_2H_6} - H = \underset{\text{Unsaturated Hydrocarbon.}}{C_2H_5}. \quad (2)\ C_2H_5 + OH = \underset{\text{Ethyl Alcohol.}}{C_2H_5OH}. \quad (3)\ \underset{\text{Ethyl Alcohol.}}{C_2H_6O} - H_2 = \underset{\text{Acetic Aldehyde.}}{C_2H_4O}.$$

The hydrogen may be removed by oxidation, when 1 atom of outside oxygen combines with 2 atoms of alcoholic hydrogen, forming 1 molecule of water and the aldehyde, which by further oxidation forms its corresponding acid.

Liquor Formaldehydi. Solution of Formaldehyde.—(Syn., Liq. Formaldehyd., Formalin, Formal, Formol; Fr. Soluté d'Aldehyde de formique; Ger. Formaldehyd solutus, Formaldehydlösung.)



$$CH_2O = C\begin{matrix} /H \\ =O \\ \backslash H \end{matrix}$$

Manufacture: Pass heated vapors of methyl alcohol mixed with air over glowing coke or copper spirals, or pass methane (marsh gas) over a heated mixture of copper, pumice, and asbestos fibres, and the resulting products of oxidation into water, removing any undecomposed methyl alcohol by subsequent distillation, and adjusting proper strength by dilution or concentration. It is a clear, colorless or nearly colorless aqueous liquid (solution), pungent odor, caustic taste, vapor an irritant to mucous membrane, miscible with water or alcohol, sometimes cloudy on long standing, especially in the cold, from separation of paraformaldehyde; evaporate over sulphuric acid, or in vacuum, have formed rapidly solid paraformaldehyde; heat above 100° C. (212° F.) sublimes; at 153–172° C. (307–342° F.) melts, evolving gaseous formaldehyde; contains 37 p. c. by weight of formaldehyde, CH_2O, with varying amounts of methyl alcohol to prevent polymerization. *Tests:* 1. Dilute 5 Ml. (Cc.) with distilled water 25 Ml. (Cc.), + 3 Ml. (Cc.) of silver ammonium nitrate T. S. —metallic silver produced either as finely divided gray precipitate or bright metallic mirror on sides of test-tube. 2. Add 2 drops to 5 Ml. (Cc.) of sulphuric acid containing a little salicylic acid, warm gently —permanent deep red color. *Impurities:* Free acids, etc. Should be kept dark, moderately warm.

PROPERTIES AND USES.—Antiseptic, disinfectant, germicide, irritant, preservative; about equal to corrosive mercuric chloride in power. A room containing 500 cubic feet can be disinfected by 1 pint (.5 L.) when converted into vapor, within an hour, or 2 pints (1 L.) will suffice for an ordinary-sized room. Has been employed largely but unlawfully for preserving milk, food, beer, wine, etc.; used also intravenously for combating septicæmia; diluted with 2–10 parts water claimed to retard growth of uterine cancer.

Veroform Germicide and *Veroform Antiseptic* are solutions of soap containing formaldehyde gas, the former 20 p. c., the latter 6 p. c., useful in sterilizing hands, etc.

Paraformaldehydum. Paraformaldehyde, $(CH_2O)_3$.—(Syn., Paraform, Trioxymethylene, Triformol; Fr. Paraldéhyde formique; Ger. Paraformaldehyd.)

Manufacture: This polymeric form of formaldehyde is obtained by evaporating formaldehyde solution (40 p. c. aqueous solution), when a portion of the gas volatilizes and another portion polymerizes and becomes insoluble, separating as white flocculent mass, which upon drying has the composition $(CH_2O)_3$. It is in white, friable masses, powder, slight odor of formaldehyde, on heating partly converted into formaldehyde and partly sublimed unchanged; slowly soluble in water, more readily in hot water with the formation of formaldehyde, insoluble in alcohol, ether, soluble in fixed alkali solutions; contains 95 p. c. of $(CH_2O)_3$. *Tests:* 1. Mix .01 Gm. with morphine sulphate .01 Gm. + 10 drops of sulphuric acid—violet-red color, changing to blue. 2. Incinerate 2 Gm.—ash .1 p. c.; shake .5 Gm., finely powdered, with 10 Ml. (Cc.) of distilled water—latter remains neutral. *Incompatibles:* Bases, oxidizing agents, gelatin, tannin, etc. Should be kept cool, dark, in well-closed containers.

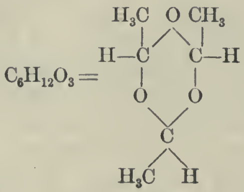
Properties and Uses.—Antiseptic (internally and externally), escharotic, disinfectant by heating (preferably compressed tablets); inhalations; warts, etc. Dose, gr. 5–15 (.3–1 Gm.); externally 10 p. c. suspension in collodion.

Hexamethylenamina. Hexamethylenamine, $C_6H_{12}N_4$. — (Syn., Hexam., Hexamethylene-tetramine, Urotropinum, Urotropine, Uritone, Formin, Aminoform, Cystogen; Br. Hexamina, Hexamine; Ger. Hexamethylentetramin(um). A condensation product of ammonia and formaldehyde.)

Manufacture: Add stronger ammonia water (80), in successive portions, to a 40 p. c. solution of formaldehyde (100), keep well cooled, set aside 12–24 hours to crystallize. It is in colorless, lustrous, odorless crystals, white crystalline powder, soluble in water (1.5), alcohol (12.5), ether (320), chloroform; aqueous solution alkaline; at 263° C. (506° F.) sublimes without melting, but with partial decomposition, emitting disagreeable odor. *Tests:* 1. Heat aqueous solution (1 in 10) with diluted sulphuric acid—decomposes with liberation of formaldehyde (odor; and darkens silver ammonium nitrate T. S. paper). 2. Heat aqueous solution (1 in 10) with diluted sulphuric acid, supersaturate with sodium hydroxide solution—ammonia evolved; incinerate 2 Gm.—residue .05 p. c. *Impurities:* Heavy metals, ammonium salts, chloride, sulphate. Should be kept in well-closed containers. Dose, gr. 5–15 (.3–1 Gm.).

Properties and Uses.—Antiseptic; it is absorbed rapidly, a value due to its partial change into and liberation as formaldehyde in the urine. The urine usually is rendered acid, but should it remain alkaline no decomposition takes place, nor is any antiseptic action secured; solvent for uric acid; similar to piperazine; pyelitis, cystitis, phosphaturia, gonorrhœa, typhoid fever, renders urine clear and acid when loaded with pus, urates and phosphates.

Paraldehydum. Paraldehyde.—(Syn., Paraldehyd.; Fr. Paraldéhyde, Elaldéhyde; Ger. Paraldehyd.) A polymer of acetaldehyde, C_2H_4O.

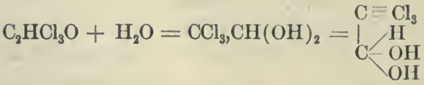


Manufacture: Paraldehyde (Gr. παρά, resembling, +) is obtained usually by passing hydrochloric acid gas into aldehyde, or by adding to ordinary (ethyl) aldehyde a small quantity of either SO_2, HCl, $ZnCl_2$, or sodium acetate; the temperature of the mixture rises, and almost a complete conversion into paraldehyde takes place. It is a colorless, transparent liquid, strong, characteristic, but not unpleasant or pungent odor, at first a burning then a cooling sensation in the mouth; soluble in water (8), boiling water (17), miscible with alcohol, chloroform, ether, volatile oils, neutral or slightly acid, sp. gr. 0.990, boils at 123° C. (253° F.), congeals at 6° C. (43° F.); when heated with a little sulphuric acid is converted into acetaldehyde, recognized by its odor. *Impurities:* Amyl alcohol, sulphuric acid, hydrochloric acid, free acid acetaldehyde, substances from fusel oil. Should be kept cool, dark, in well-closed containers. Dose, ♏xv–60 (1–4 Ml. (Cc.)), largely diluted with syrup and flavored with tincture of orange peel or some aromatic, the taste being disagreeable.

PROPERTIES.—Soporific, hypnotic, antiseptic; no influence over pain. Excessive doses weaken heart-action. Kills by paralysis of the respiratory centre, moderate doses cause 5–7 hours of refreshing, dreamless sleep, without unpleasant after-effects. May create *paraldehyde-habit,* emaciation, etc.

USES.—Same indications as hydrated chloral—insomnia from mental strain, insanity, mania, melancholia, delirium tremens, cardiac affections, allays itching in jaundice, vomiting in nauseating headache, pregnancy, and irritable ovary, excellent in strychnine-poisoning, morphine-habit, often produces erythematous rash.

Chloralum Hydratum. Hydrated Chloral.—(Syn., Chloral. Hydrat., Chloral, Chloral Hydrate, Aldehydum Trichloratum, Hydrous Chloral, Trichloraldehyde Hydrate; Br. Chloral Hydras; Fr. Hydrate de Chloral; Ger. Chloralum hydratum, Chloralhydrat.) A compound of trichloraldehyde or chloral with the elements of 1 molecule of water.



$$C_2HCl_3O + H_2O = CCl_3{,}CH(OH)_2 = \begin{matrix} C = Cl_3 \\ | \\ C \begin{matrix} \diagup H \\ - OH \\ \diagdown OH \end{matrix} \end{matrix}$$

Manufacture: Chloral (*chlor*(ine) + *al*(cohol)) is acetic aldehyde, C_2H_4O, in which 3 hydrogen atoms have been replaced by 3 chlorine atoms, and is made, as the name would suggest, by passing dry chlorine gas into anhydrous alcohol until saturated, which requires from a few hours to many weeks, according to amount of alcohol operated upon; when hydrochloric acid gas ceases to distil the temperature is increased gradually to 70° C. (158° F.), and the saturated liquid, which congeals on cooling, is shaken with sulphuric acid to decompose chloral alcoholate, remove alcohol and other impurities; the colorless oily layer that separates is removed and rectified direct over lime and calcium carbonate; this rectified distillate (anhydrous chloral) is mixed with water (82 parts chloral + 10 water), mixture poured upon plates under bell-glass, and allowed to crystallize—hydrated chloral—$C_2H_6O + 2Cl = C_2H_4O + 2HCl$; $C_2H_4O + 6Cl = C_2HCl_3O + 3HCl$. It is in rhomboidal, colorless, transparent crystals, aromatic, penetrating, slightly acrid odor, bitterish, caustic taste, soluble in water (.25), alcohol (1.3), chloroform (2), ether (1.5), olive oil, oil of turpentine; liquefies when treated with an equal quantity of camphor, menthol, phenol, or thymol; decomposed by caustic alkalies, alkaline earths, ammonia, chloroform—a formate of the base being produced; contains 99.5 p. c. of hydrated chloral. *Tests:* 1. Warm with a few drops of aniline and sodium hydroxide T. S.—intensely disagreeable odor of phenyl-isocyanide. 2. Incinerate—ash .05 p. c.; does not readily attract moisture. *Impurities:* Hydrochloric acid, chlorides, chloral alcoholate, ethyl carbonate, organic substances. Should be kept cool, dark, in tightly-stoppered bottles. Dose, gr. 5–20 (.3–1.3 Gm.), not safe to exceed this owing to possible cumulative tendency, etc.

PREPARATIONS.—(Unoff.): *Mistura Chloralis et Potassii Bromidi Composita*, 20 Gm., + potassium bromide 20, extract of cannabis .2, extract of hyoscyamus .2, pumice 2, water q. s. 100, dose, ʒss–2 (2–8 Ml. (Cc.)). *Syrupus Chloral* (Br.), 20 p. c., dose, ʒss–2 (2–8 Ml. (Cc.)).

PROPERTIES.—Externally—antiseptic, vesicant, irritant, anodyne. Internally—soporific, hypnotic, gastric irritant, general depressant (vasomotor centre, also heart becomes slow, feeble, irregular, stopping in diastole), produces sleep quickly, is certain, and has no unpleasant after-effects, circulates in the blood unchanged, may be decomposed finally if urine is alkaline.

USES.—Externally—mixed with camphor, menthol, etc., anodyne in neuralgia, caries of teeth, for toothache, foul sores, ulcers, fetor of feet, chapped nipples, erectile tumor, gonorrhœa, diphtheria, night-sweats. Internally—nervous insomnia from overwork, worry, etc., acute fevers, acute congestion of brain, cerebral inflammation, mania, delirium tremens, tetanus, hysteria, chorea, epilepsy, local spasms, asthma, strangulated hernia, spasm of the glottis, spasmodic croup, hiccough, incontinence of urine, insanity, to relieve pain, nervous headache, angina pectoris, convulsions, whooping-cough, dysentery, typhoid fever, strychnine, hyoscine, and calabar bean poisoning.

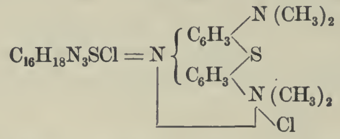
Poisoning: Resembles opium somewhat; have deep coma, weak, irregular, slow pulse, pupils dilated when awake, slow respiration, lividity, reflexes abolished, skin cold, temperature below normal. Give emetics or wash out stomach, weak potassium hydroxide solution, cold to head and neck; abundant fresh air, cataplasms, hot bottles, blankets, massage and friction to increase heat; keep awake with coffee, caffeine, galvanism, flagellation, hypodermic strychnine or picrotoxin, inhale amyl nitrite to stimulate heart, artificial respiration.

Chloral habit (*toxæmia, chloralism*) is soon acquired, and is manifested in voluble speech, injected eyes, gastro-intestinal irritation, erythematous eruptions, dyspnœa, general weakness, and permanent mental disturbance. To cure, should withdraw drug, use hygienic and medicinal tonics with cannabis.

Incompatibles: Alkalies, lime water, atropine, strychnine, external heat.

Synergists: Hypnotics, morphine (also lessens heart depression).

Methylthioninæ Chloridum. Methylthionine Chloride.—(Syn., Methylthionin. Chlor., Methylthininæ Hydrochloridum, U. S. P. 1900, Methylene Blue, Methylenum Cæruleum, Tetramethylthionine Hydrochloride; Fr. Chlorhydrate de Tetraméthylethionine; Ger. Tetramethylthioninchlorid, Methylen Blau.)

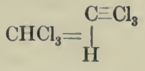


$$C_{16}H_{18}N_3SCl = N\left\{\begin{array}{l} C_6H_3\left\langle\begin{array}{l} N(CH_3)_2 \\ S \end{array}\right. \\ C_6H_3\left\langle\begin{array}{l} N(CH_3)_2 \\ Cl \end{array}\right. \end{array}\right.$$

Manufacture: This tetramethylthionine chloride, $C_{16}H_{18}N_3SCl + 3H_2O$, is obtained by treating para-amido-dimethylaniline in hydrochloric acid solution with hydrogen sulphide, and subsequently with ferric chloride; or act upon para-amido-dimethylaniline hydrochloride with sodium nitrite, hydrogen sulphide and ferric chloride. It is a dark green, crystalline powder or prismatic crystals with bronze-like lustre, soluble in water, alcohol, chloroform, the solutions being deep blue. *Tests:* 1. Aqueous solution with hydrochloric acid changes to lighter blue; with sodium hydroxide T. S. changes to purple, and if in excess produces, on standing, a dull violet precipitate. 2. Solution in diluted sulphuric acid, + zinc dust—decolorizes gradually; incinerate .5 Gm.—ash 1 p. c. *Impurities:* Arsenic, zinc, dextrin. Dose, gr. 1–5 (.06–.3 Gm.).

PROPERTIES AND USES.—Should not be confounded with methyl blue; anodyne, antiperiodic, antipyretic, analgesic, antiseptic; rheumatism, neuralgia, cystitis, intermittent fevers (good substitute for quinine), urethritis, colors urine blue, and may irritate neck of bladder.

Chloroformum. Chloroform.—(Syn., Chlorof., Chloroformum Purificatum, Formylum Trichloratum, Terchloride of Formyl, Dichlormethyl Chloride; Fr. Chloroforme (pur); Ger. Chloroformium, Chloroform.) A liquid consisting of 99–99.4 p. c. by weight of absolute chloroform and .6–1 p. c. of alcohol.



$$CHCl_3 = \overset{C \equiv Cl_3}{\underset{H}{|}}$$

Manufacture: Chloroform (*chlor*(ine) + *form*(yl)) is the trichloride of methane, or methyl, CH_4, in which 3 hydrogen atoms are removed and replaced by 3 chlorine atoms. In actual practice, water 24 parts, alcohol 1, chlorinated lime 6, are put into a still and heated to 50° C. (122° F.), when chloroform, alcohol and water distil over, the heat from chemical reaction being sufficient to continue the process; the distillate consists of two layers, and the lower is removed, thoroughly washed with water (to get rid of undecomposed alcohol), then repeatedly with sulphuric acid until it is no longer discolored; now treat with sodium carbonate solution, wash with water, dehydrate with calcium chloride, potassium carbonate or phosphoric anhydride, and fractionally distil, collecting that coming over at 59–62° C. (138–144° F.). Here the chlorine of the lime converts alcohol into aldehyde, then into chloral, which is decomposed at once by the inherently formed alkali—calcium hydroxide—into chloroform and calcium formate, $Ca(CHO_2)_2$, hence the various names—$2C_2H_6O + Ca(OCl)_2 = 2C_2H_4O + CaCl_2 + 2H_2O$; $2C_2H_4O + 3Ca(OCl)_2 = 2C_2HCl_3O + 3Ca(OH)_2$; $2C_2HCl_3O$ (chloral) $+ Ca(OH)_2 = 2CHCl_3 + Ca(CHO_2)_2$. This process has now given way to that of acetone, which consists in distilling acetone (10) diluted with water (30) + chlorinated lime (100) with water (300); purify as above—$2C_3H_6O + 3Ca(OCl)_2 = 2C_3H_3OCl_3 + 3Ca(OH)_2$; $2(C_3H_3OCl_3) + Ca(OH)_2 = 2CHCl_3 + Ca(C_2H_3O_2)_2$. It is a clear, colorless, mobile liquid, characteristic, ethereal odor, burning, sweet taste, soluble in water (210), miscible with alcohol, ether, benzene, petroleum benzin, fixed or volatile oils, boils at 61° C. (142° F.), sp. gr. 1.476, non-inflammable, but its heated vapor burns with a green flame. *Test:* 1. Pour 20 Ml. (Cc.) upon odorless filter paper on a warmed glass plate, rock plate from side to side until liquid evaporated—no foreign odor perceptible as last portions disappear, paper odorless. *Impurities:* Chlorides, free chlorine, substances decomposable by sulphuric acid (dark), chlorinated and odorous decomposition compounds. Should be kept cool, dark, in well-stoppered bottles, and care should be used in vaporizing it in the presence of naked flame, as noxious gases are produced.

Purification: When chloroform contains any of the preceding, it should be purified by taking 400 Gm. and shaking with H_2SO_4 80 Gm. occasionally for 24 hours, avoiding exposure to bright daylight; this process chars and removes hydrocarbons; now separate lighter chloroform layer and shake it with dried Na_2CO_3 20 Gm. to free from acid, transfer chloroform to dry retort, add deodorized alcohol 4 Ml. (Cc.), and distil at 67° C. (153° F.) until the distillate measures 255 Ml. (Cc.). Dose, ♏ij–20 (.13–1.3 Ml. (Cc.)).

Preparations.—1. *Aqua Chloroformi.* Chloroform Water. (Syn., Aq. Chlorof.; Fr. Eau de Chloroforme; Ger. Chloroformwasser.)

Manufacture: To a convenient quantity of recently boiled distilled water (750 Ml. (Cc.)), in a dark amber-colored bottle, add enough chloroform (4 Ml. (Cc.)) to maintain slight excess of latter after repeated and thorough shaking; when required for use pour off needed quantity, refill bottle with recently boiled distilled water, saturate by thorough agitation, always preserving an excess of chloroform. Should be kept cool, dark. Dose, ʒj–4 (4–15 Ml. (Cc.)).

2. *Linimentum Chloroformi.* Chloroform Liniment. (Syn., Lin. Chlorof.; Fr. Liniment au Chloroforme; Ger. Chloroformliniment.)

Manufacture: 30 p. c. Mix by agitation chloroform 30 Ml. (Cc.) and soap liniment 70 Ml. (Cc.); used externally.

3. *Spiritus Chloroformi.* Spirit of Chloroform. (Syn., Sp. Chlorof., Chloric Ether, Spirit of Chloric Ether; Fr. Alcoolat (Alcoolé) de Chloroforme; Ger. Chloroformspiritus.)

Manufacture: 6 p. c. Mix chloroform 6 Ml. (Cc.) with alcohol q. s. 100 Ml. (Cc.). Dose, ʒss–1 (2–4 Ml. (Cc.)).

Unoff. Preps.: Emulsum Chloroformi—chloroform 4 Ml. (Cc.), expressed oil of almond 6 Ml. (Cc.), tragacanth 1 Gm., water q. s. 100 Ml. (Cc.), dose, ʒj–4 (4–15 Ml. (Cc.)). *Mistura Chloroformi et Morphinæ Composita,* 12.5 p. c., + morphine sulphate .25, ether 3.25, tinct. of cannabis 18.50, tinct. of capsicum 2.5, oil of peppermint .2, glycerin 12.5, water 6.5, alcohol q. s. 100, dose, ♏xv–60 (1–4 Ml. (Cc.)). *Tinctura Chloroformi et Morphinæ Composita* (Br.), chloroform 7.5 p. c., morphine hydrochloride 1, diluted hydrocyanic acid .5, tincture of capsicum .25, tincture of Indian hemp 10, dose, ♏v–15 (.3–1 Ml. (Cc.)).

Properties.—Internally—irritant, anæsthetic locally, astringent, stimulant, narcotic. The *first stage* is that of general stimulation, excited imagination, feeling of warmth and comfort, mind incoherent, confused, pupils dilated, may laugh, kick, fight, vomit, or cry unconsciously, pulse increases, heart and great vessels throb, may have choking, cessation of breathing, flushed face; the *second stage* is that of depression, complete unconsciousness, sees, hears, and feels nothing; *third stage* is that of total abolition of reflex excitability, may pass urine and fæces involuntarily. Externally—irritant, vesicant, anæsthetic. Should not be given to those having lung affections, fatty or feeble hearts, nor to the very old.

Uses.—Internally or inhalation—toothache, dyspepsia, setting fractured bones, dislocations, strangulated hernias, hiccough, chorea, hysteria, whooping-cough, asthma, angina pectoris, biliary and nephritic colic, tetanus, hydrophobia, tic douloureux, vomiting of pregnancy, labor, painter's colic, dysmenorrhœa, spasms of bladder or rectum, gastric ulcer, colic, pain from calculi, convulsions, fevers. Externally—toothache, headache, rheumatism, neuralgia, dysmenorrhœa, painful parturition, swelled testicle, hæmorrhoids, hemorrhage, tæniæ.

When inhaled, should be with abundance (95 p. c.) of air. It requires usually 2–3 minutes to produce insensibility (much more quickly than with ether), which lasts only 5–10 minutes, unless inhalation is continued or morphine injected, which latter prolongs the effect considerably. One fluidrachm (250 drops; 4 Ml. (Cc.)) will suffice for each inhalation, though more at the initial stage often is required.

Poisoning: Have irregular, shallow, stertorous breathing, dilated pupils. If swallowed, empty the stomach by pump, siphon, or emetics, give enema of hot coffee, large draughts of water containing sodium bicarbonate, demulcents, and treat as if inhaled, thus: Lower the head, pull forward the tongue to admit air, artificial respiration for an hour, electricity, hot and cold douche, inhale amyl nitrite, ether, ammonia, friction, heat, give brandy, atropine, strychnine. One death occurs in every 3000 inhalations. On recovery, first the muscles regain power of involuntary motion, sensibility next is regained, and lastly consciousness, which may require hours for perfect restoration. There is never remembrance of occurrences during the insensibility; even the nausea, vomiting, etc., are wholly involuntary.

Incompatibles: Weak alcoholic spirits, glycerin, stimulants, galvanism.

Synergists: Anæsthetics, alcohol, hydrated chloral, morphine, etc.

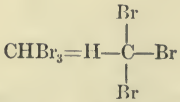
Allied Product:

1. *Chloretone,* $C_4H_7OCl_3$.—Obtained by the interaction of chloroform, acetone, and an alkali, and occurs in white crystals, soluble in alcohol, largely in warm water, sparingly in cold, sublimes at body temperature into white glistening needles, stable in presence of diluted acids and alkalies; permanent, non-toxic, non-irritating.

Properties and Uses.—Hypnotic, analgesic, local anæsthetic, anodyne, sedative, antiseptic; resembles cocaine, but has less toxic effects upon the heart; slightly lessens pulse-rate, but does not reduce force of cardiac systole nor lower the blood-pressure; considered superior to cocaine, beta-eucaine, hydrated chloral, sulphonal, trional, etc., for insomnia, gastric carcinoma, gastritis, sea-sickness, vomiting of pregnancy, nausea, wounds, cuts, abrasions, minor operations. Dose, gr. 5–15 (.3–1 Gm.); apply locally the powder or saturated aqueous solution.

Chloroform made by the acetone process has been sold under this name, with the recommendation of its not reducing the force of cardiac systole nor lowering blood-pressure.

Bromoformum. Bromoform.—(Syn., Bromof., Methyl Tribromide, Tribrom-methane, Dibromomethyl-bromide; Gr. Bromoformium.)



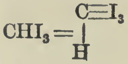
$$CHBr_3{=}H{-}\overset{\displaystyle Br}{\overset{|}{\underset{\underset{\displaystyle Br}{|}}{C}}}{-}Br$$

Manufacture: Chlorinated lime (60) is made into paste with water and added to potassium bromide (71.5) dissolved in water (150), add acetone (12), distil in current of steam until oily drops cease to come over, cool apparatus, add chlorinated lime (60), acetone (9), distil, repeat this operation three times with similar parts of chlorinated lime and acetone, wash distillates, shake with sulphuric acid, again wash with water, and solution sodium hydroxide, dehydrate with fused calcium chloride, distil at 150° C. (302° F.), reserving the distillate; or add bromine gradually to solution of potassium hydroxide in alcohol as long as the color is discharged; or act on acetone with potassium (calcium) hypobromite, distil — $C_3H_6O + 3KBrO = C_3H_3Br_3O + 3KOH$; $C_3H_3Br_3O + KOH = CHBr_3 + KC_2H_3O_2$. It is a heavy, transparent, colorless, mobile liquid, ethereal odor, penetrating, sweet taste, resembling chloroform, slightly soluble in water; miscible with alcohol, chloroform, ether, benzene, petroleum benzin, fixed or volatile oils, sp. gr. 2.610, slightly volatile, non-inflammable, vapors may be burned; contains 96 p. c., by weight, of bromoform and 4 p. c. of dehydrated alcohol; a fluidrachm represents 360 drops. *Test:* 1. Evaporate 10 Ml. (Cc.) from porcelain dish on water-bath—residue .006 Gm. *Impurities:* Acetone, bromides, brominated compounds, free bromine, free acids. Should be kept cool, dark, in glass-stoppered bottles. Dose, ♏ij–5 (.13–.3 Ml. (Cc.)), on sugar, in capsules, in alcohol, glycerin, or compound tincture of cardamom.

Properties and Uses.—Anæsthetic by inhalation, but has caused alarming symptoms, sufficient to prevent its employment; like chloroform depresses reflex centres of spine, decreasing their functions; produces sleep, insensibility to pain by depressing action upon cerebral centres; depresses vasomotor centre, lessening blood-pressure thus dissipates heat; pulse remains full and strong, as heart and peripheral vagi are seemingly not affected. Chiefly employed internally as a palliative in whooping-cough, decreasing the number and intensity of paroxysms, but does not shorten the disease, also given for hiccough, spasmodic asthma, laryngismus stridulus, cough of phthisis, chronic bronchitis, reflex headache, vertigo.

Poisoning: Laughing intoxication, nausea, vomiting, cyanosis, loss of reflex action, coma, collapse, cardiac failure, extreme pallor, fatty degeneration of the viscera. Use external heat, hypodermic ether and strychnine, electricity, which generally return consciousness in 4–6 hours.

Iodoformum. Iodoform. — (Syn., Iodof., Diiodomethyl-iodide, Carboneum Jodatum, Ioduretum Carbonici, Triiodomethane; Fr. Iodure de Formyle, Iodoforme; Ger. Jodoformium, Jodoform.)



$$CHI_3 = \overset{C\equiv I_3}{\underset{H}{|}}$$

Manufacture: Iodoform (*iod*(ine) + (chlor)*oform*) is the triiodide of methane (triiodomethane), or methyl, CH_4, where 3 hydrogen atoms are removed and replaced by 3 iodine atoms, similar to chlorine in chloroform; obtained practically by the action of iodine upon alcohol (acetone), in the presence of an alkali or alkali carbonate: heat together in a closed vessel iodine, alcohol (acetone), potassium bicarbonate (carbonate, hydroxide)—$C_2H_5OH + 4I_2 + 2KHCO_3 = 2CHI_3 + 2KI + 3H_2O + 2CO_2$. It is a fine, lemon-yellow powder, lustrous hexagonal crystals; peculiar, very penetrating, persistent odor; unpleasant, slightly sweetish taste, suggestive of iodine; nearly insoluble in water, soluble in alcohol (60), boiling alcohol (16), glycerin (80), chloroform (10), ether (7.5), carbon disulphide (2.8), olive oil (34); solutions neutral; contains 96.69 p. c. of iodine. *Tests:* 1. Slightly volatile at ordinary temperatures, in boiling water distils slowly with the steam; melts at 115° C. (239° F.) to a brown liquid, decomposes at higher temperature, emitting vapors of iodine. 2. Incinerate 1 Gm. —ash .2 p. c.; dry 1 Gm. over sulphuric acid for 24 hours—loss only 1 p. c. *Impurities:* Acids, alkalies, picric acid, soluble yellow coloring matter. Should be kept cool, dark, in well-closed containers. Dose, gr. 1–3 (.06–.2 Gm.), in pill; externally, as ointment, in collodion, alcohol, liniments, suppositories, gauzes, etc., or in dry powder.

PREPARATIONS.—1. *Unguentum Iodoformi.* Iodoform Ointment. (Syn., Ung. Iodof.; Fr. Pommade d'Iodoforme; Ger. Jodoformsalbe.) *Manufacture:* 10 p. c. Triturate thoroughly iodoform 10 Gm. with benzoinated lard 90 Gm., gradually added.

Unoff. Preps.: Iodoformum Aromatisatum, 96 p. c., + coumarin 4. *Collodium Iodoformi,* 5 p. c., + flexible collodion 95. *Glycerogelatinum Iodoformi,* 10 p. c., + glycer. gelatin 10, glycerine 15, dist. water 65. *Petroxolinum Iodoformi,* 3 p. c., + acetone 20, oleic acid 10, eucalyptol 3, liquid petroxolin 64.

PROPERTIES.—Internally—increases appetite, narcotic, eliminated by secretions, chiefly in urine, as iodine, iodides, and iodates. Externally — antiseptic, disinfectant, analgesic, local stimulant, anæsthetic.

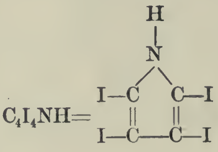
USES.—Externally—ulcers, sores, wounds, tuberculous and syphilitic ulcers, cancer, metritis, endometritis, swollen glands, pleural effusions, also of pericardium, inflamed joints, diphtheria, chronic cystitis, goitre, gonorrhœa, buboes, ozæna, ulcer of tongue, chronic otorrhœa, ringworm of scalp, purulent ophthalmia, ulcerated eyelids, corneal ulcers, hemorrhoids, lupus, pruritus of vagina and testes, skin diseases (eczema, psoriasis, prurigo), erysipelas, ulcers of larynx, nasal catarrh, gangrene, vaginismus, neuralgia, heart disease, orchitis, carious teeth, boils, carbuncles, scrofula. The odor may be modified by the addition of some aromatic substance, such as vanillin, musk, oils of bergamot, lavender, peppermint, sassafras, etc., balsam of Peru, thymol, eucalyptol, etc.

Poisoning: Usually have symptoms of meningitis—headache, stupor, gastro-intestinal irritation, melancholia, hallucinations, contracted pupils, high temperature, erythema, delirium, rapid pulse, death. Give potassium bromide, which dissolves the iodine compound, lemonade, potassium acetate solutions, stimulants, diaphoretics, diuretics, warm sponge bath, small repeated doses of tincture of opium, large doses of potassium bicarbonate, diluents freely.

Incompatibles: Mercuric chloride, etc.

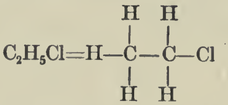
Related Product:

1. *Iodolum. Iodol* (Tetraiodo-pyrrol, Pyrrol Tetraiodide), C_4I_4NH, official 1900–1910.



Obtained from pyrrol, which in turn comes from Dippel's oil (bone oil), by purifying and acting upon it with iodine in alcoholic solution for 24 hours, then adding water to separate the iodol. It is a light grayish-brown crystalline powder, odorless, tasteless, soluble in fixed oils, sulphuric acid, alcohol (9), ether (1.5), chloroform (105), water (4900), decomposes at 145° C. (293° F.), liberating violet iodine vapors; contains iodine 88.97 p. c. *Impurities:* Inorganic substances, hydriodic acid, iodides, free iodine. Antiseptic, stimulant, a substitute for iodoform externally and for potassium iodide internally; tertiary syphilis, scrofula, diabetes, eczema, wounds. Dose, gr. ½–10 (.03–.6 Gm.).

Æthylis Chloridum. Ethyl Chloride.—(Syn., Æthyl. Chlor., Æthylum Chloratum, Æther Chloratus, Monochlorethane, Hydrochloric Ether; Fr. Chlorure d'Éthyle, Ether hydrochlorique; Ger. Äthylchlorid, Chlorwasserstoffäther.)

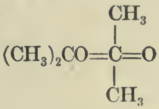


$$C_2H_5Cl=H-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-Cl$$

Manufacture: Pass dry hydrochloric acid gas into alcohol, distil at moderate heat, wash distillate with water and weak alkaline solution, rectify; or heat equal volumes of alcohol and hydrochloric acid for a time under increased pressure (40 atmospheres) at 150° C. (302° F.), distil resulting product, pass vapors through warm water, then over calcium chloride (to dry), and condense in well-cooled vessels—$C_2H_5OH + HCl = C_2H_5Cl + H_2O$. It is at low temperatures a colorless, mobile, very volatile liquid, characteristic, ethereal odor, burning taste; soluble in alcohol, ether, slightly in water; sp. gr. 0.921; boils at 13° C. (55° F.); burns with smoky, greenish flame producing hydrogen chloride. *Tests:* 1. Dissolve 1 Ml. (Cc.) in alcohol (20), both at melting ice temperature, + few drops of silver nitrate T. S.—no turbidity at once (abs. of hydrochloric acid). 2. Shake 10 Ml. (Cc.) with equal volume of distilled water, both at melting ice temperature, allow supernatant ethyl chloride to evaporate, add to residual, neutral liquid a few drops of potassium dichromate T. S. + some diluted sulphuric acid, boil—no odor of aldehyde, nor greenish or purplish liquid (abs. of alcohol). 3. Evaporate 5 Ml. (Cc.)—no foreign odor at the last traces, and no weighable residue. *Impurities:* Hydrochloric acid, alcohol, etc. When liberated, at ordinary room temperature, from its sealed container it vaporizes at once, the gas being very inflammable and therefore must not be used in proximity to fire. On the market in small glass tubes, the pointed apex of which is broken off and the ethyl chloride vaporized by heat of the hand. Should be kept cool, dark, remote from fire in hermetically sealed containers. Dose, ♏x–30 (.6–2 Ml. (Cc.)).

PROPERTIES AND USES.—Local and general anæsthetic; in the former it freezes the part, producing white spot, and not until then is the incision made; used to benumb nerves in supraorbital neuralgia; in minor surgical operations, dentistry, etc.

Acetonum. Acetone.—(Syn., Aceton., Dimethyl-ketone, Acetylmethylid, Spiritus Pyroaceticus, Pyroacetic Spirit; Fr. Esprit pyroacétique; Ger. Essiggeist, Mesitalkohol.)



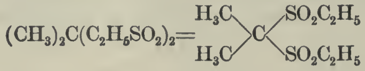
$$(CH_3)_2CO=\underset{\underset{\displaystyle CH_3}{|}}{\overset{\overset{\displaystyle CH_3}{|}}{C}}=O$$

Manufacture: By the dry distillation of wood, of acetates, citric acid, sugar (carbohydrates) + lime, but chiefly from calcium acetate—$Ca(C_2H_3O_2)_2$ + dry distillation = $(CH_3)_2CO + CaCO_3$; the distillate is neutralized with dry sodium carbonate, treated with calcium chloride and purified by fractional distillation over lime; now made largely by decomposing acetic acid vapor by passing it through a rotating iron cylinder containing pumice stone and precipitated barium carbonate, at a temperature of 500–600° C. (932–1112° F.)—$2HC_2H_3O_2$ + heat = $C_3H_6O + CO_2 + H_2O$. It is a transparent, colorless, mobile, volatile, neutral liquid, characteristic ethereal odor, pungent, sweetish taste; miscible without cloudiness with water, alcohol, ether, chloroform, volatile oils; sp. gr. 0.790; boils at 57° C. (135° F.); inflammable—luminous non-sooty flame; contains 99 p. c. by weight of acetone. *Tests:* 1. Evaporate 25 Ml. (Cc.)—residue .002 Gm. 2. Mix 20 Ml. (Cc.) with $\frac{N}{10}$ potassium permanganate V. S. (.1)—pink tint should not disappear in less than 15 minutes (lim. of empyreumatic substances). *Impurities:* Empyreumatic substances, etc. Should be kept cool, remote from fire, in well-closed containers. Dose, ♏x–20 (.6–1.3 Ml. (Cc.)).

PROPERTIES AND USES.—Anæsthetic, soporific, anthelmintic, rheumatism, gout, nausea, diarrhœa, mostly as a solvent for resins, fats, oleoresins, camphor, gun-cotton, preparing chloroform—yielding of this 200 p. c. of its own weight when distilled with water and calcium hypochlorite.

2. Sulphur Derivatives.

Sulphonmethanum. Sulphonmethane, $C_7H_{16}S_2O_4$. — (Syn., Sulphonmeth., Sulphonal, Sulphonalum, Diethylsulphonedimethylmethane; Fr. Acetone-dimethylsulphone; Ger. Sulfonal.)

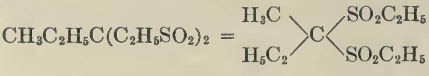


$$(CH_3)_2C(C_2H_5SO_2)_2 = \begin{matrix} H_3C \\ H_3C \end{matrix} > C < \begin{matrix} SO_2C_2H_5 \\ SO_2C_2H_5 \end{matrix}$$

Manufacture: Pass dry hydrochloric acid gas into a mixture of anhydrous ethyl hydrosulphide, mercaptan, C_2H_5SH, (2) and anhydrous acetone (1), when the mixture gradually becomes hot and turbid, finally separating into two layers, the upper containing dithio-ethyl-dimethyl-methane (acetone mercaptol), $(CH_3)_2C(SC_2H_5)_2$, a condensation-product of the interaction between the mercaptan and acetone; this oily liquid is purified by washing, distilling, and shaking with 5 p. c. solution of potassium permanganate, thus oxidizing mercaptol into sulphonmethane. It is in colorless, inodorous, nearly tasteless prismatic crystals, crystalline powder, soluble in benzene, water (365), boiling water (16), alcohol (60), boiling alcohol (3), chloroform (11). *Tests:* 1. Melts at 125° C. (257° F.), at higher temperature—decomposes evolving sulphur dioxide. 2. Heat .1 Gm. with powdered charcoal .1 Gm.—characteristic unpleasant odor of mercaptan; incinerate 2 Gm.—ash .05 p. c. *Impurities:* Chloride, sulphate, readily oxidizable substances. Should be kept in well-closed containers. Dose, gr. 15–30 (1–2 Gm.).

Properties and Uses.—Hypnotic, sedative. Resembles hydrated chloral, but is less apt to affect the heart; kills, however, by paralysis of respiration; it is given for the same conditions as hydrated chloral, but being so insoluble is absorbed slowly, hence is tardy in action; insomnia, delirium, typhoid fever, diabetes. Give an hour before bedtime in wine, beer, elixir, soup, milk, hot water, tablet or capsule.

Sulphonethylmethanum. Sulphonethylmethane, $C_8H_{18}S_2O_4$. — (Syn., Sulphonethylmeth., Trional, Trionalum, Diethylsulphonemethylethylmethane; Fr. Diéthylsulfone-méthyléthylméthane; Ger. Methylsulfonalum, Methylsulfonal.)



$$CH_3C_2H_5C(C_2H_5SO_2)_2 = \begin{matrix} H_3C \\ H_5C_2 \end{matrix} > C < \begin{matrix} SO_2C_2H_5 \\ SO_2C_2H_5 \end{matrix}$$

Manufacture: Pass dry hydrochloric acid gas into a mixture of ethyl mercaptan and methylethylketone until saturated, oxidize the resulting condensation-product, methylethylketonemercaptol, $(CH_3)(C_2H_5)C(SC_2H_5)_2$, with solution of potassium permanganate, purifying by frequent recrystallization from boiling water. It is in colorless, lustrous, odorless, crystalline scales, bitter taste in aqueous solution, soluble in alcohol, ether, water (200), more so in boiling water; saturated aqueous solution neutral. Responds to tests for identity and purity of sulphonmethane. Should be kept in well-closed containers. Dose, gr. 15–30 (1–2 Gm.).

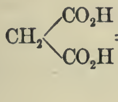
Properties and Uses.—Hypnotic, sedative for the insane. Has prompt action without cumulative effect or tendency to create a habit; quicker and more certain than sulphonal, and largely used.

IV. Acids.

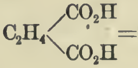
Acids are obtained from hydrocarbons by removing a hydrogen atom and substituting for it the univalent group carboxyl, CO_2H, or from alcohols by replacing 2 hydrogen atoms with 1 oxygen atom, thus:

CH_4	CH_3CO_2H	C_2H_6	$C_2H_5CO_2H$
Methane.	Acetic Acid.	Ethane.	Propionic Acid.

When this substitution is 1 hydrogen atom for 1 carboxyl we have resulting monobasic acids; when 2 hydrogen atoms are replaced by 2 carboxyl we have dibasic acids, etc., thus:



$CH_2\begin{cases}CO_2H\\CO_2H\end{cases}$ =Malonic Acid.



$C_2H_4\begin{cases}CO_2H\\CO_2H\end{cases}$ =Succinic Acid, etc.

1. Monobasic Fatty Acids.

(These have 1 hydrogen atom replaceable by metals.)

Acidum Aceticum. Acetic Acid, $HC_2H_3O_2$ = $CH_3,COOH$.—(Syn., Acid. Acet.; Fr. Acide acétique; Ger. Essigsäure.) An aqueous solution containing 36–37 p. c. of $HC_2H_3O_2$.

Manufacture: While this may be obtained by the oxidation of ethyl alcohol, most of it is the result of the dry distillation of wood, preferably white oak (*Quer'cus al'ba*), which is dry distilled at 205° C. (401° F.) for 7 days; gases, such as acetylene, C_2H_2, ethylene, C_2H_4, propene, C_3H_6, marsh gas, CH_4, carbon-dioxide, CO_2, etc., escape; the wood, losing one-half in weight, becoming walnut-colored, but retaining original structure and elementary composition, remains in the retort, as does also a dark liquid, in two strata, at the bottom: the upper—aqueous, slightly colored, amounts to about 30 p. c. of the original weight of wood taken and is crude wood vinegar or pyroligneous acid, containing also methyl alcohol, acetone, guaiacol, pyrocatechin, furfurol, etc.; the lower—oily, is tarry and contains creosote, etc. The upper liquid is distilled, the first 10 p. c. going over being alcohol and acetone, while the next 75–80 p. c. is a yellow liquid, Acetum pyrolignosum rectificatum, P. G., with about 6 p. c. of acetic acid. This is now boiled with milk of lime, or neutralized with soda ash or sodium carbonate, giving calcium or sodium acetate in solution (if milk of lime used, should double decompose with sodium sulphate to get sodium acetate), filter solution, concentrate, crystallize, and distil this with H_2SO_4, when we get acetic acid of desired strength; thus, $NaC_2H_3O_2 + H_2SO_4 = HC_2H_3O_2 + NaHSO_4$. A more modern method, and one now usually employed, consists in securing from charcoal burners the acetic acid in the form of calcium acetate, dissolving and decomposing it with sodium sulphate, thus precipitating calcium sulphate and leaving sodium acetate in solution, which in turn is filtered and treated as the above similar solution. It is a clear, colorless liquid; strong, characteristic, vinegar-like odor; sharply acid taste and reaction; miscible with water, alcohol; sp. gr. 1.045. *Tests:* 1. Nearly neutralize with ammonia water, + ferric chloride T. S.—blood-red, discharged by sulphuric acid. 2. Evaporate 20 Ml. (Cc.)—residue .002 Gm. *Impurities:* Heavy metals, formic, hydrochloric, sulphuric, sulphurous acids, empyreumatic substances.

PREPARATIONS.—1. *Acidum Aceticum Dilutum.* Diluted Acetic Acid. (Syn., Acid. Acet. Dil.; Fr. Acide acétique dilué; Ger. Acetum Purum (Distillatum), Verdünnte Essigsäure.)

Manufacture: Mix acetic acid 120 Gm. with distilled water 610 Gm. It is an aqueous solution containing 5.7–6.3 p. c. of $HC_2H_3O_2$; miscible with water, alcohol; sp. gr. 1.008. *Tests* and *Impurities:* Same as for strong acid. Dose, ʒj–4 (4–15 Ml. (Cc.)).

Unoff. Prep.: Acetum Aromaticum, 26 p. c., + oils of lavender, rosemary, juniper, peppermint, and cinnamon, each .05, oils of lemon and clove, each .1, alcohol 25, water q. s. 100.

Much of the weaker acetic acid is the result of weak alcohol or aldehyde oxidation, made by allowing diluted alcohol (8–10 p. c.) to trickle downward through wood-shavings packed in barrels, so as to afford free circulation of air, the percolate being returned as often as (four times) required for complete oxidation. The presence of the growth "mother of vinegar" (*Mycoder'ma ace'ti*) facilitates greatly the conversion—$C_2H_5OH + O_2 = C_2H_3O,OH + H_2O$. This usually is called vinegar, and contains about 4–5 p. c. of pure acetic acid.

Acidum Aceticum Glaciale. Glacial Acetic Acid, $HC_2H_3O_2$.—(Syn., Acid. Acet. Glac.; Br. Acidum Aceticum (Concentratum), Acetum Glaciale; Fr. Acide acétique (concentré) Crystallizable, Esprit de Vinaigre, Acetum glacialé, Vinaigre Glacial; Ger. Essigsäure, Eisessig.)

Manufacture: Sodium acetate 13.5 parts, deprived of water of crystallization (then making 8.25 parts), is distilled with H_2SO_4 9.5 to 10 parts, when the distillate can be evaporated and crystallized at 0° C. (32° F.)—$NaC_2H_3O_2 + H_2SO_4 = HC_2H_3O_2 + NaHSO_4$. Every 136 parts of crystallized sodium acetate yields 60 parts of acetic acid. It is a clear, colorless liquid, strong, vinegar-like odor, pungent, acid taste and reaction, sp. gr. 1.047, congeals into crystals at 14.5° C. (58° F.), boils at 117° (243° F.), miscible with water, alcohol; contains 99 p. c. of $HC_2H_3O_2$. *Tests* and *Impurities:* Same as for acetic acid, if diluted to its strength, but when 2 Ml. (Cc.) are mixed with distilled water (10), + $\frac{N}{10}$ potassium permanganate V. S. (.1)—tint (pink) produced not changed to brown within 2 hours.

Properties.—Corrosive, irritant, refrigerant, astringent.

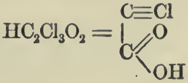
Uses.—Vapor applied to nostrils as an excitant in syncope, asphyxia, headache. Glacial Acid—mostly applied externally to warts, corns, for blistering, favus, lichen, prurigo, psoriasis, cancer, nasal polypus.

Allied Products:

1. *Acetum. Vinegar*, official 1820–1880.—Obtained by the acetous fermentation of infusions of malted and unmalted grain, or of various fruit juices.

2. *Acidum Aceticum Empyreumaticum. Pyroligneous Acid*, official 1830–1840. (Syn., Fr. Acide acétique du bois, Acide pyroacétique (pyroligneux); Ger. Roher Holzessig(säure).) Obtained by the destructive distillation of wood; yield of acetic acid 6–8–9 p. c.

Acidum Trichloraceticum. Trichloracetic Acid, $HC_2Cl_3O_2$.—(Syn., Acid. Trichloracet., Chloracetic Acid; Fr. Acide trichloracetique; Ger. Trichloressigsäure.) A monobasic organic acid containing 99 p. c. of $HC_2Cl_3O_2$.



Manufacture: Add fuming nitric acid 63 Gm. to hydrated chloral 165.5 Gm., previously fused at 58° C. (136° F.), set aside mixture for an hour, or until red vapors cease to be formed, then carefully distil at 190° C. (374° F.). It is in colorless, deliquescent, rhombohedral crystals, slight, characteristic odor, acid reaction; soluble in water (.1), very soluble in alcohol, ether; heated with potassium hydroxide T. S.—decomposes into chloroform and potassium carbonate; incinerate 2 Gm.—ash .05 p. c. *Tests:* 1. Aqueous solution (1 in 20) 10 Ml. (Cc.), + few drops of silver nitrate T. S.—only slightly opalescent (abs. of chlorides). 2. Dissolve in 5 Ml. (Cc.) of aqueous solution (1 in 20) a small crystal of ferrous sulphate, pour solution upon sulphuric acid, free from nitrogen compounds (5), so as to form a layer above—no brownish-red at zone of contact of two liquids (abs. of nitric acid).

Properties and Uses.—Antiseptic, escharotic. Penetrates deeply, but causes less pain than either silver nitrate, zinc chloride, or potassium hydroxide. Removes warts, condylomata, lupus, diseases of the nose and throat; used here in preference to chromic acid.

Acidum Oleicum. Oleic Acid, $HC_{18}H_{33}O_2$.—(Syn., Acid. Oleic., Acidum (Oleinicum) Elainicum, Elaic Acid; Fr. Acide oléique; Ger. Oleinsäure, Oelsäure.) An acid obtained from fats, consisting chiefly of $HC_{18}H_{33}O_2$.

Manufacture: Digest almond oil with lead oxide and water, when dry separate oleate of lead from other salts by solution in ether, precipitate lead from ethereal solution with hydrochloric acid, evaporate filtrate; large quantities are obtained also as a by-product in making stearic acid for stearin candles. It is a yellowish, brownish-yellow, oily liquid, peculiar, lard-like odor and taste free from rancidity; darker and absorbs oxygen on exposure; insoluble in water, partially soluble in 60 p. c. alcohol, much more so in alcohol, miscible with 85 p. c. alcohol; soluble in chloroform, benzene, petroleum benzin, fixed or volatile oils, sp. gr. 0.895; semi-solid at 9° C. (48° F.), congeals to solid, whitish mass at 4° C. (39° F.), begins to decompose at 95° C. (203° F.) producing acid vapors. *Tests:* 1. Incinerate 5 Ml. (Cc.)—ash .005 Gm. 2. Shake with distilled water (1); the separated water after filtration + a drop of methyl orange T. S.—not reddened (abs. of mineral acids). 3. Boil 1 Gm. + monohydrated sodium carbonate (.5) + distilled water (30) in a capacious flask—resulting solution, while hot, clear or possibly opalescent (abs. of undecomposed fat, mineral oil). *Impurities:* Mineral acids, undecomposed fat or mineral oil). Should be kept cool, in well-closed glass or stoneware containers.

PREPARATIONS.—1. *Oleatum Hydrargyri,* 75 p. c.

Unoff. Preps.: Oleates of Aconitine (50), *Atropine* (50), *Cocaine* (50), *Quinine* (75), *Veratrine* (50), etc.

PROPERTIES AND USES.—Important, since it is a solvent for medicines to be applied by inunction and the base of official oleates, which do not decompose (becoming rancid, etc.) like ointments, and enter the skin deeper without irritation. Oleate of Mercury—good in skin diseases (sycosis, chloasma, pediculi), syphilitic affections, thinning and loss of hair; oleates of atropine, cocaine quinine, veratrine, zinc, and some other unofficial oleates are very useful.

Acidum Stearicum. Stearic Acid, $HC_{18}H_{35}O_2$.—(Syn., Acid. Stear., Acidum Stearinicum; Fr. Acide stêarique; Ger. Stearinsäure.) An acid obtained from tallow and other solid fats, consisting chiefly of $HC_{18}H_{35}O_2$.

Manufacture: This exists as the glyceride in all solid animal fats and in many oils, and is prepared from tallow by boiling with NaOH or K_2CO_3; this forms sodium stearate (soap) and liberates glycerin—$C_3H_5(C_{18}H_{35}O_2)_3 + 3NaOH = C_3H_5(OH)_3 + 3NaC_{18}H_{35}O_2$. The soap is decomposed by heating with water and H_2SO_4 (or HCl), thus setting free the fatty acids, which, floating on the surface, are removed; upon cooling, the solid acid mixture is subjected to strong pressure, thereby removing the fluid acids, oleic, etc. It is a hard, white, yellowish, glossy solid, odorless, slight tallow-like odor, tasteless, permanent, soluble in alcohol (21), chloroform (2), ether (3), freely in carbon disulphide, carbon tetrachloride, almost insoluble in water; melts at 56° C. (133° F.); congeals at 54° C. (129° F.); incinerate 1 Gm.—residue .1 p. c. *Tests:* 1. Boil 1 Gm. + monohydrated sodium carbonate .5 Gm. + distilled water 30 Ml. (Cc.) in capacious flask—hot solution not more than opalescent (abs. of undecomposed fat, paraffin). 2. Melt, shake with hot distilled water (1); separated water after filtration, + a drop of methyl orange T. S.—not reddened (abs. of mineral acids). *Impurities:* Undecomposed fat, paraffin, mineral acids.

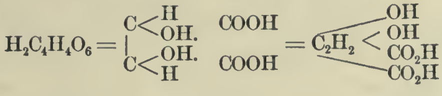
Preparation.—1. *Suppositoria Glycerini,* each 3 gr. (.2 Gm.).

Properties and Uses.—Mainly in manufacturing glycerin suppositories, and as zinc and copper stearates, for various skin diseases.

2. Dibasic Fatty Acids.

(These have 2 hydrogen atoms replaceable by metals.)

Acidum Tartaricum. Tartaric Acid.—(Syn., Acid. Tart., Sal Essentiali Tartari, Dioxysuccinic Acid; Fr. Acide du Tartre—tartrique; Ger. Acidum tartaricum, Weinsäure, Weinsteinsäure.) A dibasic organic acid, usually obtained from wine lees or argol, containing 99.5 p. c. of $H_2C_4H_4O_6$.



$$H_2C_4H_4O_6 = \begin{array}{l} C<^{H}_{OH.} \\ | \\ C<^{OH.}_{H} \end{array} \begin{array}{l} COOH \\ \\ COOH \end{array} = C_2H_2 < \begin{array}{l} OH \\ OH \\ CO_2H \\ CO_2H \end{array}$$

Manufacture: Tartaric acid is found in vegetables and fruits, free and combined with potassium or calcium. The grape contains most, having it in the form of potassium acid tartrate, crude tartar, or argol. This substance is soluble in an aqueous saccharine solution, as of fresh grape juice; but when the weak saccharine solution begins to ferment alcohol is formed, in which argol is not soluble, consequently it is precipitated. Although argol is principally potassium acid tartrate, it also contains some calcium, magnesium, iron and aluminum salts. It is dissolved in water at 140–170° C. (284–338° F.) under pressure, clear solution not quite neutralized with chalk, adding only until effervescence nearly ceases, in order to retain in solution the magnesium, iron and aluminum salts — $2KHC_4H_4O_6 + CaCO_3 = CaC_4H_4O_6 + K_2C_4H_4O_6 + CO_2 + H_2O$; calcium chloride is now added to the hot mixture to convert remaining soluble normal potassium tartrate into insoluble calcium tartrate — $K_2C_4H_4O_6 + CaCl_2 = CaC_4H_4O_6 + 2KCl$; the resulting calcium tartrate is washed and heated with diluted sulphuric acid at 75° C. (167° F.); the solution of free acid is evaporated in lead vacuum pans and allowed to crystallize in lead-lined vats—$CaC_4H_4O_6 + H_2SO_4 = H_2C_4H_4O_6 + CaSO_4$. It is in colorless, translucent, monoclinic prisms, white granular or fine powder; odorless; acid taste and reaction; permanent; soluble in water (.75), boiling water (.5), alcohol (3.3), slightly in ether, almost insoluble in chloroform. *Tests:* 1. Aqueous solution (1 in 2), + equal volume aqueous solution of potassium acetate (1 in 3)—white, crystalline precipitate, soluble in solution of alkalies, mineral acids, but insoluble in acetic

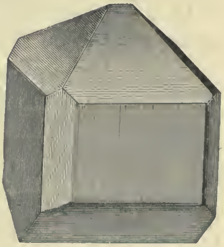


Fig. 467.—Tartaric acid crystal.

acid. 2. Ignited—gradually decomposes with odor of burning sugar; incinerate 2 Gm.—ash .05 p. c. *Impurities:* Heavy metals, lead, sulphuric, oxalic acids. Dose, gr. 5–30 (.3–2 Gm.).

PREPARATIONS.—1. *Effervescent Salts*, 25.2 p. c., etc.

PROPERTIES AND USES.—Owing to its greater cheapness is much used in place of citric acid in making lemonade, effervescing drinks, powders, etc. When mixed with sugar, mucilage, aromatics, etc., it serves to moisten the throat in pharyngitis, pulmonary catarrh, to dissolve false membranes of diphtheria, correct fetor of feet, etc.

Related Acid:

1. *Acidum Oxalicum. Oxalic Acid,* $H_2C_2O_4,2H_2O$, official 1870–1880.—Obtained by oxidizing many organic substances (fats, sugars, starch, etc.) with nitric acid or other strong oxidizing agents; also on large scale by heating sawdust with KOH and NaOH at 250° C. (482° F.) to form oxalates, adding calcium hydroxide to alkaline oxalate solution to produce insoluble calcium oxalate, decomposing this with sulphuric or hydrochloric acid; found natively in many plants (*Oxalis, Rumex, Rheum,* and other genera) as acid calcium or potassium oxalate, also in urine as calcium oxalate. It is in large, transparent, colorless crystals, soluble in water, alcohol, heated highly splits into H_2O,CO_2,CO—very poisonous.

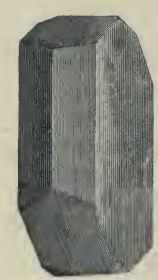


FIG. 468.—Oxalic acid crystal.

PREPARATION.—1. *Tenth-normal Oxalic Acid Volumetric Solution.*

Manufacture: Dissolve purified oxalic acid 6.45 Gm., in distilled water q. s. 1,000 Ml. (Cc.).

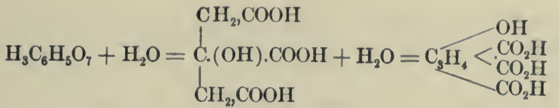
PROPERTIES AND USES.—Poisonous, reducing agent, decolorizes permanganate solutions, precipitates gold and platinum solutions, removes iron stains from linen, paper, fabrics. Acid potassium oxalates under names *salt of sorrel, salt of lemon,* are also much used in decolorizing tissues of various kinds. Owing to close resemblance of oxalic acid to Epsom salt, fatal poisonings have resulted from mistaking the former for the latter.

Poisoning: Have vomiting, burning pain, constriction of throat and stomach, collapse, drowsiness, stupor, dark-colored discharges, death. Empty stomach, then give powdered chalk, whiting, or wall-plaster in water, slaked lime (lime water), dried whitewash, to form insoluble oxalate, hot fomentations to loins, enema, oil, abundant water, opium.

3. TRIBASIC FATTY ACIDS.

(These acids have 3 hydrogen atoms replaceable by metals.)

Acidum Citricum. Citric Acid.—(Syn., Acid. Cit., Acidum Citri—Limonis—Limonum—Limonorum; Fr. Acide (du Citron) citrique; Ger. Acidum citricum, Citronensäure, Citronsäure.)



$$H_3C_6H_5O_7 + H_2O = \begin{array}{l} CH_2,COOH \\ | \\ C.(OH).COOH \\ | \\ CH_2,COOH \end{array} + H_2O = C_3H_4 < \begin{array}{l} OH \\ CO_2H \\ CO_2H \\ CO_2H \end{array}$$

Manufacture: This tribasic organic acid occurs in juices of plants, especially in their fruit, as strawberry, raspberry, cherry, currant, lemon, lime, gooseberry, whortleberry, cranberry, tamarind, tomato, etc.; it is usually prepared from the juice of limes or lemons by first clarifying by ebullition, neutralizing with chalk and washing the resulting calcium citrate with boiling water, in which it is sparingly soluble, decomposing with diluted sulphuric acid; strain out calcium sulphate, concentrate, allow to crystallize in wooden vats lined with lead: (1) $2H_3C_6H_5O_7 + 3CaCO_3 = Ca_3(C_6H_5O_7)_2 + 3CO_2 + 3H_2O$. (2) $Ca_3(C_6H_6O_7)_2 + 3H_2SO_4 = 2H_3C_6H_5O_7 + 3CaSO_4$. It is in colorless, translucent, right-rhombic prisms, white powder; odorless; acid taste; efflorescent in warm air; soluble in water (.5), boiling water (.5), alcohol (1.8), ether (30); contains 99.5 p. c. of $H_3C_6H_5O_7 + H_2O$. *Tests:* 1. Aqueous solution (1 in 10) acid, which, rendered alkaline by calcium hydroxide T. S., remains clear, but, on boiling, becomes opaque (calcium citrate). 2. Slowly ignited, decomposes without odor of burning sugar (dif. from tartaric acid). 3. Nearly neutralize aqueous solution (1 in 10) with ammonia water, + calcium sulphate T. S.—clear (abs. of oxalic acid); incinerate 2 Gm.—ash .05 p. c. *Impurities:* Heavy metals, lead, oxalic, sulphuric, tartaric acids. Dose, gr. 5–30 (.3–2 Gm.).

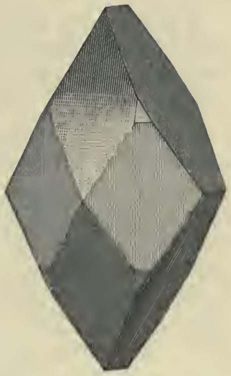


Fig. 469.—Citric acid crystal.

Preparations.—1. *Syrupus Acidi Citrici.* Syrup of Citric Acid. (Syn., Syr. Acid. Cit.; Fr. Sirop (d'Acide citrique) de Limon; Ger. Citronsäuresirup.)

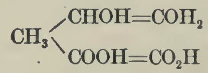
Manufacture: 1 p. c. Dissolve citric acid 1 Gm. in distilled water 1 Ml. (Cc.), add it to syrup 95 Ml. (Cc.), mix well; add tincture of lemon peel 1 Ml. (Cc.), shake, add syrup q. s. 100 Ml. (Cc.), mix thoroughly. Should be kept in containers previously washed with boiling water, and not dispensed unless free from molds and fermentation products. Dose, ʒj–4 (4–15 Ml. (Cc.)).

2. *Liquor Magnesii Citratis,* 33 Gm. per bottle (350 Ml. (Cc.)).

3. *Effervescent Salts,* 16.2–19.5–25 p. c., etc.

Properties and Uses.—Irritant, antiscorbutic, stimulant, diuretic, refrigerant; rheumatism, hemorrhage, jaundice, scurvy, fevers, antidote to alkaline and narcotic poisons, good locally for diphtheritic angina, gangrenous sore mouth, jaundice, pruritus, cancerous tumors, reduces obesity, prolonged usage emaciates.

Acidum Lacticum. Lactic Acid, $HC_3H_5O_3$. — (Syn., Acid. Lact., Isolactic, Ethyledene-lactic, or Oxypropionic Acid; Fr. Acide lactique; Ger. Acidum lacticum, Milchsäure.) A liquid containing lactic acid and lactic anhydrides equivalent to 85–90 p. c. of $HC_3H_5O_3$. This is the second member of a group of monobasic diatomic acids which contain two hydroxyl groups, the hydrogen in one (the upper, COH_2) being replaceable by alcohol, that of the other (lower, CO_2H) by metals:



$$CH_3\left\langle\begin{matrix}CHOH{=}COH_2\\COOH{=}CO_2H\end{matrix}\right.$$

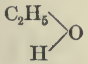
Manufacture: Lactic acid occurs in gastric juice, urine, intestinal juices, many plant-juices, sour milk, sour cabbage, and is produced from sugar by the special lactic ferment (*Bacte'rium lac'tis*). Allow milk sugar, or inverted sugar, milk, or cheese and water to undergo fermentation, at 25–35° C. (77–95° F.), neutralize acid as fast as formed with chalk or zinc oxide, as butyric acid will be produced if much free lactic acid present, recrystallize resulting calcium or zinc lactate, decompose with sulphuric acid or hydrogen sulphide, evaporate filtrate. It is a colorless, yellowish, syrupy liquid, nearly odorless, acid taste and reaction; absorbs moisture on exposure; miscible with water, alcohol, ether; insoluble in chloroform, petroleum benzin, carbon disulphide; sp. gr. 1.206; does not vaporize below 160° C. (320° F.), and at higher temperature emits inflammable vapors. *Tests:* 1. Add to 2 Ml. (Cc.) of equal volumes of lactic and sulphuric acids, potassium permanganate .1 Gm., heat gently—aldehyde odor. 2. Incinerate 5 Ml. (Cc.)—ash .006 Gm. *Impurities:* Heavy metals, chloride, sulphate, organic substances, sugars, citric, oxalic, phosphoric, sarcolactic, tartaric acids, glycerin. Dose, ʒss–2 (2–8 Ml. (Cc.)), in lemonade; if by enema, the acid should be neutralized by sodium bicarbonate.

PREPARATION.—1. *Syrupus Calcii Lactophosphatis*, 6 p. c.

PROPERTIES AND USES.—Caustic, large doses hypnotic, stomachic. Lactic acid has gained its popularity from the fact of its being one of the constituents of the gastric juice, etc. Given in dyspepsia, phosphatic deposits, tuberculous diarrhœa, green infantile diarrhœa, diabetes, rheumatism, otitis, ulcers of nasal fossæ, diphtheria, croup, insomnia, caustic to fungous caries, lupus, epithelioma, ulcers, tuberculous ulcers, laryngeal and pharyngeal affections (morbid growths, etc.).

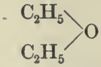
V. Ethers.

These are formed from alcohols by replacing the hydrogen of hydroxyl by the same or other alcohol radicals, thus:



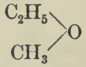
$$\begin{matrix}C_2H_5\\H\end{matrix}\!\!>\!O$$

Ethyl Alcohol



$$\begin{matrix}C_2H_5\\C_2H_5\end{matrix}\!\!>\!O$$

Ethyl Ether

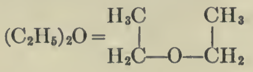


$$\begin{matrix}C_2H_5\\CH_3\end{matrix}\!\!>\!O$$

Ethyl-methyl Ether

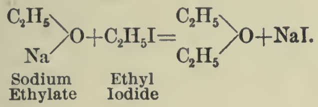
Ethers are the oxides of organic radicals or residues, and these latter may be alike or different, thus giving simple or mixed ethers.

Æther. Ether.—(Syn., Æther Fortior, Æther Sulphuricus, Hydric Ether, Naphtha Vitrioli, Hydrate of Ethylen, Oxide of Ethyl; Fr. Ether hydrique—vinique—sulfurique; Ger. Äther, Schwefeläther.) A liquid containing 95.5–97.5 p. c. of ethyl oxide, $(C_2H_5)_2O$, the remainder consisting of alcohol containing a little water.

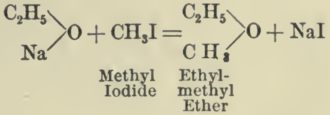


$$(C_2H_5)_2O = \begin{matrix} H_3C & & CH_3 \\ | & & | \\ H_2C & —O— & CH_2 \end{matrix}$$

Manufacture: 1. By action of chloride or iodide of hydrocarbon residue upon an alcohol in which the hydrogen of hydroxyl has been replaced by a metal:

(1) 

$$\begin{matrix} C_2H_5 \\ Na \end{matrix}\!>\!O + C_2H_5I = \begin{matrix} C_2H_5 \\ C_2H_5 \end{matrix}\!>\!O + NaI.$$

(2) 

$$\begin{matrix} C_2H_5 \\ Na \end{matrix}\!>\!O + CH_3I = \begin{matrix} C_2H_5 \\ CH_3 \end{matrix}\!>\!O + NaI$$

2. By action of sulphuric acid on alcohols, whereby 1 molecule of water is abstracted from 2 molecules of alcohol; this is the general process, and consists in distilling together alcohol and sulphuric acid at about 130° C. (266° F.), passing the vapors through two purifiers, one of cast iron containing solution potassium hydroxide to remove water and other impurities, the other of block-tin containing pebble-stones to recondense alcoholic and other vapors of higher boiling-points than ether.

$$C_2H_5OH + H_2SO_4 = \underset{\text{Ethylsulphuric acid.}}{C_2H_5HSO_4} + H_2O$$

This ethylsulphuric acid acts upon another alcohol molecule, giving ether—$C_2H_6HSO_4 + C_2H_5OH = (C_2H_5)_2O + H_2SO_4$. This process, in theory, is continuous, the H_2SO_4, last formed again acting on fresh alcohol as it is supplied; in practice this is not true, as the H_2SO_4 becomes, after a time, so weak from the accumulated water, which never entirely goes over, that it will not act upon the alcohol. Each gallon (4 L.) of alcohol yields about 4 pounds (2 Kg.) of ether. It is a transparent, colorless, mobile liquid; characteristic odor; burning, sweetish taste; soluble in water (12) with slight contraction of volume; miscible with alcohol, chloroform, petroleum benzin, benzene, fixed or volatile oils, highly volatile and inflammable, its vapor mixed with air exploding violently; slowly oxidizes by air into peroxides; sp. gr. 0.715; boils at 35° C. (95° F.). *Tests:* 1. Does not change dampened blue litmus to red in 10 minutes. 2. Spontaneous evaporated residue moistened—odorless, neither reddens nor bleaches blue litmus. 3. Evaporate 30 Ml. (Cc.)—residue .001 Gm.; evaporated from blotting paper—no foreign odor at the last traces. *Impurities:* Water, alcohol, aldehyde, peroxides, mostly removed by the purifiers. Should be kept cool, dark, remote from fire in partially filled, well-closed containers (preferably tin cans); when for anæsthesia should be dispensed only in small, well-closed containers, and not used after the latter have been opened 24 hours. Dose, ♏v–60 (.3–4 Ml. (Cc.)).

Preparations.—1. *Spiritus Ætheris.* Spirit of Ether. (Syn., Sp. Æth., Hoffmann's Drops, Liquor Anodynus Mineralis Hoffmanni; Fr. Æther Sulfuricus Alcoolisatus, Ether hydrique (sulfurique) alcoolisé, Liqueur anodine d'Hoffmann; Ger. Spiritus æthereus, Ätherweingeist, Hoffmann'(sche) Tropfen.)

Manufacture: Mix ether 32.5 Ml. (Cc.), with alcohol q. s. 100 Ml. (Cc.). Dose, ♏xv–60 (1–4 Ml. (Cc.)).

Unoff. Preps.: Oleum Æthereum (*Ethereal Oil*): add slowly sulphuric acid 1000 Ml. (Cc.) to alcohol 1000 Ml. (Cc.), after 24 hours distil until all oily drops have passed over, separate yellow ethereal liquid portion, expose to the air for 24 hours, filter off aqueous portion, wash oil left on filter with cold distilled water 25 Ml. (Cc.), when drained add to oil an equal volume of ether. *Spiritus Ætheris Compositus* (*Hoffmann's Anodyne*): ether 32.5 Ml. (Cc.), alcohol 65 Ml. (Cc.), ethereal oil 2.5 Ml. (Cc.), dose, ♏v–60 (.3–4 Ml. (Cc.)).

Properties.—Internally—acts like chloroform or alcohol, cardiac stimulant, anæsthetic, narcotic, carminative, antispasmodic. Externally—irritant, local anæsthetic, stimulant, refrigerant. The heart, vasomotor and respiratory centres are paralyzed much less easily by ether than by chloroform; ether, however, is a more intense renal and bronchial irritant, also more likely to induce vomiting and a more protracted stage of stimulation, hence more struggling.

Uses.—Internally—nausea, dyspepsia, flatulent and biliary colic, neuralgia of the gums, earache, fainting, cardiac failure or palpitation, asthma; here more rapid than chloroform in action, hence for these cases it is better. Ether is inhaled to blunt sensibility in surgical operations, to relax muscles in dislocations, strangulated hernia, neuralgia, biliary and renal colic, dysmenorrhœa, tetanus, spasms, asthma, chronic bronchitis, labor, extracting teeth, headache, vomiting of pregnancy, hysteria, tæniæ, biliary calculi, whooping-cough, spasmodic croup, delirium tremens, mania, lumbago, sciatica, collapse in opium- and hydrated-chloral-poisoning, convulsions. Should inhale ether slowly through the nostrils, on empty stomach, and watch the pulse closely. If beats become slow, feeble, or quick, the sponge should at once be removed; best inhaled from sponge fixed in a paper cone having the larger end over the face and the smaller end cut off to admit a small amount (30 p. c.) of air. It requires about ℥ij (60 Ml. (Cc.)) and 5–15 minutes to produce insensibility. On recovery have more nausea and vomiting than follows chloroform, which may be checked by sodium bromide gr. 15 (1 Gm.); should not use it at night, and never near flame or fire. One death occurs from every 16,000 inhalations. Externally—headache, toothache, earache, neuralgia, deafness, photophobia, hernia, hiccough, malignant pustule, carbuncle, tonsillitis. Also may freeze by ether part to be operated upon, and thus deaden pain. The two spirits are useful in sleeplessness, restlessness, nervous disturbance, hysteria, flatulent and uterine colic.

Incompatibles: Arterial sedatives, strychnine, picrotoxin.

Synergists: Arterial and cerebral stimulants, chloroform, alcohol, etc.

Allied Product:

1. *Æther Aceticus, Acetic Ether,* $C_2H_5C_2H_3O_2$, official 1880–1910.—This liquid, composed of 96 p. c., by volume, of ethyl acetate, $C_2H_5C_2H_3O_2$, and 4 p. c. of alcohol with a little water, is obtained by setting aside 1–2 days, in a well-closed flask, alcohol 63 Gm. and sulphuric acid 111 Gm., in order to form ethylsulphuric acid, adding this to a retort containing powdered anhydrous sodium acetate 82 Gm., heating retort on water-bath, condensing vapors in a well-cooled receiver —$C_2H_5OH + H_2SO_4 = C_2H_5HSO_4 + H_2O$; $C_2H_5HSO_4 + NaC_2H_3O_2 = C_2H_5C_2H_3O_2 + NaHSO_4$; purify (from acetic acid, alcohol, water) by shaking with one-third volume of aqueous solution containing 20 p. c. of sodium chloride and 2 p. c. of sodium carbonate (acetic acid), decanting carefully the ethereal layer, shaking with freshly ignited potassium carbonate (water), distilling (alcohol). It is a transparent, colorless liquid, fragrant, refreshing acetous odor, peculiar acetous, burning taste, volatile, inflammable, sp. gr. 0.890, boils at 72° C. (162° F.), soluble in water (7), miscible with alcohol, ether, fixed or volatile oils. Stimulant, antispasmodic, carminative, acts like ether but has a more pleasant taste; syncope, nervous agitation, colic, flatulence; inhaled for laryngeal and bronchial irritation, nervous cough; externally—same as ether. Should be kept cool, dark, remote from lights or fire, in well-stoppered bottles. Dose, ♏xv–30 (1–2 Ml. (Cc.)), well diluted.

Spiritus Ætheris Nitrosi. Spirit of Nitrous Ether, $C_2H_5NO_2$.—(Syn., Sp. Æth. Nitros., Sweet Spirit of Nitre, Spiritus Nitri Dulcis, Ethyl Nitrite, Spiritus Nitrico-Äthereus; Fr. Éther azoteux alcoolisé, Liqueur anodine nitreuse; Ger. Spiritus Ätheris nitrosi, Versüsster Salpetergeist.) An alcoholic solution of ethyl nitrite, $C_2H_5NO_2$, containing 3.5–4.5 p. c. of ethyl nitrite.

Manufacture: Mix sulphuric acid 40 Ml. (Cc.) with water 120 Ml. (Cc.), cool, add diluted alcohol 170 Ml. (Cc.), pour into a 1000 Ml. (Cc.) flask, surrounded by ice and water; dissolve sodium nitrite 100 Gm. in water 280 Ml. (Cc.), filter, pour into a separatory funnel, let slowly drop into flask containing acid mixture, when reaction complete allow crystals, if any, to settle, decant quickly cold mixture of ethyl nitrite and aqueous solution to the previously cooled separatory funnel, draw off and discard aqueous liquid; wash separated ethyl nitrite with ice-cold water 20 Ml. (Cc.), then with ice-cold water 15 Ml. (Cc.) containing monohydrated sodium carbonate .6 Gm. (to remove traces of acid), separate ethyl nitrite from aqueous liquid, agitate it in well-stoppered bottle with potassium carbonate 3 Gm.

(to remove traces of water), cool, decant immediately ethyl nitrite into a tared bottle containing alcohol 500 Gm.; ascertain weight of ethyl nitrite by noting increase in weight of tared bottle and contents, add alcohol q. s. to make mixture weigh 22 times the weight of ethyl nitrite added. It is a clear, mobile, volatile, inflammable liquid, pale yellow, faintly greenish-yellow, fragrant, ethereal, pungent odor free from acridity; sharp, burning taste; neutral, but acid by age; sp. gr. 0.823. *Tests:* 1. Must not effervesce upon adding a crystal of potassium bicarbonate. 2. Immerse a test-tube half-filled with it in a water-bath at 65° C. (149° F.)—when that temperature acquired it boils upon adding a few pieces of broken glass. *Impurities:* Aldehyde, etc. Should be kept cool, dark, remote from fire, in small, well-stoppered, dark amber-colored bottles. Dose, ʒss–2 (2–8 Ml. (Cc.)).

Preparations.—1. *Mistura Glycyrrhizæ Composita,* 3 p. c.

Unoff. Prep.: Liquor Ethyl Nitritis (Br.), ethyl nitrite 2.5–3 p. c. (+ alcohol 95, glycerin 5), dose, ♏xx–60 (1.3–4 Ml. (Cc.)).

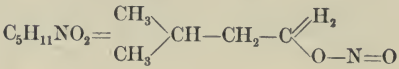
Properties.—Diffusible stimulant, stomachic, carminative, diaphoretic, diuretic, anæsthetic, antispasmodic, antipyretic.

Uses.—Febrile condition to promote sweating, strangury, urinary and kidney affections, flatulence, nausea, nervous agitation, coughing, headache, chronic bronchitis, fevers, in ordinary cold, chronic Bright's, cardiac, and pulmonary diseases.

Incompatibles: Potassium iodide, ferric sulphate, mucilage of acacia, tincture of guaiac(um), antipyrine, emulsions, tannin, gallic acid.

Synergists: Diaphoretics, diuretics, antispasmodics, potassium citrate, tincture of aconite, etc.

Amylis Nitris. **Amyl Nitrite,** $C_5H_{11}NO_2$.—(Syn., Amyl. Nitris, Amyl Æther Nitrosus, Amylonitrous Ether; Fr. Azotite d'Amyl, Ether amylozoteux; Ger. Amylium nitrosum, Amylnitrit.) A liquid containing 80 p. c. of amyl (chiefly iso-amyl) nitrite.



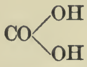
$$C_5H_{11}NO_2 = (CH_3)_2{>}CH-CH_2-C{\overset{H_2}{}}-O-N{=}O$$

Manufacture: Distil sodium nitrite, amyl alcohol, and diluted sulphuric acid, collecting that vaporizing at 95–100° C. (203–212° F.); wash distillate with ice-cold solution of sodium carbonate (to remove acid), dehydrate with anhydrous potassium carbonate, redistil below 100° C. (212° F.)—$2C_5H_{11}OH + 2NaNO_2 + H_2SO_4 = 2C_5H_{11}NO_2 + Na_2SO_4 + 2H_2O$; or distil equal volumes pure amyl alcohol and nitric acid—$C_5H_{11}OH + HNO_3$ (deoxidizing into HNO_2) $= C_5H_{11}NO_2 + H_2O$. It is a clear, yellowish liquid, peculiar, ethereal, fruity odor, pungent, aromatic taste, almost insoluble in water, miscible with alcohol, ether, very volatile, inflammable, yellow luminous sooty flame. *Tests:* 1. 2 drops + 2 drops of water + 2 Ml. (Cc.) sulphuric acid—amyl valerate, recognized by odor on dilution with water. 2. Add few drops to 1 Ml. (Cc.) of ferrous sulphate T. S. + 5 Ml. (Cc.) of diluted hydrochloric acid—greenish-brown. *Impurities:* Free acid, aldehyde. Should be kept cool, dark, in hermetically sealed glass bulbs, or glass-stoppered vials. Dose, ♏j–3 (.06–.2 Ml. (Cc.)), cautiously inhaled from a handkerchief in which a glass tear (capsule) containing the amyl nitrite has been crushed. Internally give ♏ss–1 (.03–.06 Ml. (Cc.)), dissolved in alcohol.

Properties.—Irritant, sedative, depressant, antispasmodic, anodyne, diuretic. Causes flushed face, rapid and violent heart-beats, throbbing head, headache, giddiness, dilated pupils, increased respiration.

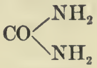
Uses.—Relax spasms, angina pectoris, functional or slight organic heart disease, asthma, convulsions following labor, spasmodic dysmenorrhœa, tetanus, hysterical convulsions, epileptic paroxysms, neuralgia, headache, whooping-cough, hiccough, vomiting of pregnancy, syncope, faintness, hepatic and renal colic, spasm of the glottis, vertigo, pneumonia, intermittent fever, night-sweats, chorea, infantile convulsions, hydrophobia, chordee, exophthalmic goitre, chloroform syncope, seasickness, strychnine-, hydrated chloral-, cocaine-, and severe carbonic acid-poisoning, insomnia from opium-habit. Externally—as an anodyne in headache, toothache, earache, neuralgia, dysmenorrhœa; fetor of gangrene, secretions, and exudations, modified by its solution. Should not be used where there is profuse hemorrhage, or when there is serious organic heart or brain disease (degeneration of arteries).

3. Urea Derivatives.



$CO\begin{matrix}\diagup OH\\ \diagdown OH\end{matrix}$

Carbonic Acid

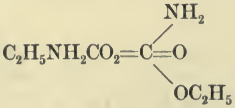


$CO\begin{matrix}\diagup NH_2\\ \diagdown NH_2\end{matrix}$

Carbamide

Urea (carbamide) is carbonic acid with its 2 hydroxyls replaced by 2 ammonia residues, NH_2, as shown above.

Æthylis Carbamas. Ethyl Carbamate, $C_3H_7NO_2$.—(Syn., Æthyl. Carbam., Urethanum, Urethane, Ethyl Urethane; Fr. Uréthane; Ger. Carbaminsäure Äthylester.) The ethyl ester $CO(OC_2H_5)NH_2$, of carbamic acid.



$C_2H_5NH_2CO_2=\overset{\diagup NH_2}{\underset{\diagdown OC_2H_5}{C}}=O$

Manufacture: Heat together urea nitrate and ethyl alcohol for several hours in a steam digester at 120–130° C. (248–266° F.). The resulting crystalline mass is dissolved in water, shaken out with ether, after recovering ether residue is distilled and crystallized from water. $(NH_2)_2COHNO_3 + C_2H_5OH = CONH_2.OC_2H_5 + NH_4NO_3$. It is in colorless columnar crystals, scales, odorless, cooling, saline taste, soluble in water (.45), alcohol (.8), glycerin (2.5), chloroform (.9), ether (1.5), olive oil (32); melts at 48° C. (119° F.); incinerate 2 Gm.—ash .05 p. c.; aqueous solution (1 in 20) neutral. *Tests:* 1. Heat 1 Gm. + sulphuric acid 5 Ml. (Cc.)—decomposition with evolution of carbon dioxide (alcohol and acid ammonium sulphate remaining in solution). 2. Heat 1 Gm. + concentrated potassium hydroxide solution (5)—evolves ammonia gas, recognized by odor. 3. Dissolve .5 Gm. in distilled water (5) + dry sodium carbonate (1) + iodine (.01), warm solution—yellow crystals of iodoform on cooling. *Impurities:* Urea, chloride, nitrate. Should be kept in well-closed containers. Dose, gr. 10–40 (.6–2.6 Gm.).

PROPERTIES AND USES.—Hypnotic, without unpleasant after-effects; resembles paraldehyde in action; overdoses depress spinal cord, heart, and respiration, death due to asphyxia; used in nervous or functional insomnia, or that due to mental or physical depression, chronic alcoholism, insanity.

II. AROMATIC SERIES.

As previously stated, all organic compounds are either derivatives of methane, CH_4 (fatty series), or of benzene, C_6H_6 (aromatic series), and while these two parental compounds are strictly hydrocarbons, they as well as their derivatives are thoroughly distinctive, as they cannot in any sense be substituted for or converted into one another. The members of the fatty series, in a degree, are products that might be used as animal food; those of the aromatic series have not this power, being simply aromatics, antiseptics, stimulants. Many compounds of this latter series are obtained directly from the vegetable kingdom, while a great number result indirectly therefrom by destructive distillation of coal in the manufacture of illuminating gas, giving us coal-tar, *pix lithanthracis,* soluble in benzene, carbon disulphide, chloroform, ether; *liquor picis carbonis*—coal-tar 20 p. c., quillaja 10, alcohol q. s. 100; externally, antiseptic, parasiticide; chronic skin affections; ointment—5–10–20–30 p. c. When this coal-tar is distilled and the distillate caught in water, it separates into two layers—*light oil* floating on top of the water, *heavy oil* sinking below the water: from the former come benzene, etc.; from the latter, phenol (carbolic acid), etc.

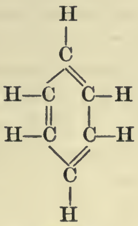
Benzenum. Benzene, C_6H_6.—(Syn., Benzol, Benzole, Phenyl Hydride, Coal Naphtha; Fr. Benzène; Ger. Benzen.) A mixture of homologous hydrocarbons, chiefly benzene, C_6H_6, 70 p. c. + toluene, C_6H_5,CH_3, 20–30 p. c.

Manufacture: Distil coal-tar, when water and ammonia pass over along with 8–10 p. c. of a brown liquid, light oil; later the dead oil is obtained containing aniline, quinoline, naphthalene, phenol (carbolic acid), etc. The light oil contains benzene, toluene, xylene, isocumene, these being separated by fractional distillation, benzene coming over at

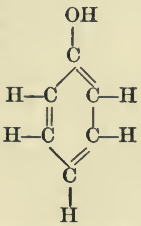
80° C. (176° F.), toluene at 110° C. (230° F.), which may be purified by exposing to a low temperature and expressing the portion remaining liquid. It is a thin, colorless, very inflammable liquid, coal-gas odor, sp. gr. 0.884, congeals at 0° C. (32° F.), soluble in ether, chloroform, acetone, alcohol (4), with nitric acid readily converted into nitrobenzene. *Impurities:* Acetylene, thiophene, carbon disulphide, toluene, xylene, etc.

Properties and Uses.—Antispasmodic, anticatarrhal, antizymotic, germicide, poisonous (causing uncertain gait, mental disturbance, wandering delirium, vertigo, loss of sexual power, epileptic convulsions, deep sleep). Used in whooping-cough, influenza; solvent for fats, volatile oils, resins, caoutchouc, sulphur, phosphorus, iodine, alkaloids (quinine, etc.). Its principal use, however, is in the manufacture of aniline, and therefrom the many important coal-tar products. Dose, ♏x–30 (.6–2 Ml. (Cc.)), emulsion; on sugar, in capsule; locally mixed with 9 parts of soapsuds.

Phenol. **Phenol,** C_6H_5OH.—(L. fr. Gr. *φαίνειν*, to show, or *φοῖν(ιξ)*, purple-red + *ol*(eum).) (Syn., Carbolic Acid, Acidum Carbolicum, Acidum Phenicum—Phenylicum (Crystallizatum), Phenic—Phenylic Acid, Phenylic Alcohol, Benzophenol; Fr. Acide carbolique—phénique, Hydrate de Phényle; Ger. Karbolsäure, Phenylsäure, Phenylalkohol.) This hydroxybenzene, obtained from coal-tar or made synthetically, is the alcohol of the hydrocarbon benzene, and according to the number of hydrogen atoms replaced by the hydroxyl, OH, we have mon-, di-, tri-atomic, etc., phenols or alcohols. This hydroxyl here is acid, whereas that in methane alcohols is basic; these phenols or phenol alcohols differ from common alcohols in not yielding aldehydes or acids by oxidation and in having hydroxyl (OH) that is acid.



Benzene.



Phenol (Carbolic Acid).

Manufacture: Phenol occurs in castoreum, urine and in products of dry distillation of bones, resins and wood, especially coal; that portion of coal-tar coming over at 100–250° C. (212–482° F.) is known as *light oil*, sp. gr. 0.940–0.990, and contains phenol 4–10 p. c. This fraction is agitated with a 10 p. c. solution sodium hydroxide (stronger solution undesirable, as it would dissolve also naphthalene, etc.), and upon standing separates into two layers—lower, being a solution of sodium-phenol—upper, consisting of the extracted oil; draw off and treat lower layer with hydrochloric or sulphuric acid sufficient for exact decomposition; the impure phenol thus liberated rises to the surface as an oily layer, which is removed and washed by agitation with concentrated solution sodium chloride, freed from water by calcium chloride, then distilled at 180–190° C. (356–374° F.); expose distillate to cold, when phenol congeals in crystalline mass, which freed from adhering liquid is again distilled at 185° C. (365° F.) and crystallized. Sometimes before final distillation it is treated with potassium dichromate and sulphuric acid, and to get colorless loose crystals may recrystallize from boiling petroleum benzin. Phenol may also be obtained from the *heavy oil*, collecting that portion coming over at 160–220° C. (320–428° F.), then treating distillate as above. Phenol may be obtained synthetically from benzene (benzol) by treating with sulphuric acid, heating—$C_6H_6 + H_2SO_4 = C_6H_5SO_2OH + H_2O$; the resulting benzene-sulphonic acid is neutralized with potassium carbonate, yielding potassium benzene-sulphonate, and this compound fused with excess of potassium hydroxide—$2(C_6H_5SO_2OK) + 4KOH = 2H_2O + 2K_2SO_3 + 2C_6H_5OK$, the latter, potassium-phenol, is treated with solution hydrochloric acid, which liberates phenol, to be purified by distillation—$C_6H_5OK + HCl = C_6H_5OH + KCl$. This process has the advantage of yielding phenol free from cresol, xylene, etc., as benzene can be used of absolute purity. It is in colorless, interlaced, or separate needle-shaped crystals, or white, crystalline mass, sometimes acquiring reddish tint, characteristic, aromatic odor, copiously diluted with water sweetish taste, slightly burning aftertaste, when undiluted cauterizes and whitens skin and mucous membrane, soluble in water (15), alcohol, glycerin, chloroform, ether, carbon disulphide, fixed or volatile oils; aqueous solution (1 in 15) clear, neutral, faintly acid, liquefied by gentle heat, forming a highly refractive liquid, or by 8 p. c. of water, congeals at 38° C. (100° F.); contains 97 p. c. of pure phenol. *Tests:* 1. Aqueous solution with bromine water—white precipitate (tribromphenol), at first redissolving, but permanent with more reagent, appearing crystalline under the microscope. 2. Aqueous solution (1 in 100) 10 Ml. (Cc.) + 1 drop of ferric chloride T. S.—violet-blue liquid. 3. Heat on water-bath 10 Gm.—volatilizes with residue .05 p. c.; vapor inflammable. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{2}$–1 (.03–.06 Gm.).

PREPARATIONS.—1. *Phenol Liquefactum.* Liquefied Phenol. (Syn., Phenol Liq., Liquefied Carbolic Acid, Acidum Carbolicum Liquefactum; Ger. Verflussigte Karbolsäure.)

Manufacture: Liquefy phenol, a convenient quantity, by placing unstoppered container in water-bath, apply heat gradually until crystals melted, transfer liquid to a tared vessel and weigh, then for each 9 Gm. of phenol add 1 Gm. of distilled water, mix thoroughly. It is a colorless liquid, sometimes acquiring a red tint, characteristic, aromatic odor, when undiluted cauterizes and whitens the skin and mucous membrane; miscible with alcohol, ether, glycerin; when diluted with equal volume of glycerin becomes miscible with water, sp. gr. 1.065, boils at 182° C. (360° F.); contains 87 p. c. of pure phenol. Should be kept dark, in well-closed containers. Dose, ♏ss–1 (.03–.06 Ml. (Cc.)).

2. *Glyceritum Phenolis.* Glycerite of Phenol. (Syn., Glycer. Phenol., Glycerite of Carbolic Acid; Br. Glycerin of Phenol; Fr. Glycéré d'Acide phénique, Glycérine phénique; Ger. Phenol (Phenyl)-glycerit.)

Manufacture: 20 p. c. Add liquefied phenol 20 Ml. (Cc.) to glycerin 80 Ml. (Cc.), mix thoroughly. Dose, ♏ij–5 (.13–.3 Ml. (Cc.)).

3. *Unguentum Phenolis.* Ointment of Phenol. (Syn., Ung. Phenol., Ointment of Carbolic Acid; Br. Unguentum Acidi Carbolici, Phenol Ointment; Fr. Pommade (d'Acide) phénique; Ger. Phenolsalbe.)

Manufacture: 2.25 p. c. Add liquefied phenol 2.25 Gm. to melted ointment 97.75 Gm., stir until it begins to congeal.

Unoff. Preps.: Phenol Iodatum, 60 p. c., + iodine 20, glycerin 20. *Petroxolinum Phenolis,* 5 p. c., + liquid petroxolin 95. *Petroxolinum Phenolis Camphoratum,* 12 p. c., + camphor 37.5, liquid petroxolin 50. *Oleum Phenolatum,* 5 p. c., + olive oil 95. *Aqua Phenolata,* 2.2 p. c., + dist. water 97.8. *Nebula Aromatica*—phenol, menthol, eucalyptol, oil of cinnamon, oil of clove, each .2 Gm., camphor, benzoic acid, each .3, thymol .1, methyl salicylate .5, light liquid petrolatum q. s. 100. *Suppositoria Acidi Carbolici* (Br.), each 1 gr. (.06 Gm.). *Trochiscus Acidi Carbolici* (Br.), each ½ gr. (.03 Gm.).

PROPERTIES.—Internally—sedative, antifermentative, antipyretic, irritant, poisonous. Externally—antizymotic, antiseptic, disinfectant, deodorant, anæsthetic, irritant caustic. Rapidly destroys animal and vegetable organized ferments, also those organisms causing septic diseases, thereby preventing the formation of their decomposition products. In the stomach is converted into a sulphophenolate, but may circulate as an alkaline phenolate. Diminishes the production of heat and increases its dissipation, renders urine dark.

USES.—Internally—vomiting, diarrhœa, flatulent dyspepsia, typhoid and intermittent fevers, scarlatina. Externally—in spray, ulcers, gangrene, phthisis, chronic bronchitis, whooping-cough, diphtheria, erysipelas, pain of burns, polypi, venereal abscesses, boils, carbuncles, hemorrhoids, varicose veins, goitre, hydrocele, sore nipples, granular ophthalmia, otorrhœa, earache, surgical operations, freckles, acne, prurigo, ringworm, warts, bee-stings, sore throat, toothache, rheumatism, bunions, diabetes.

Poisoning: Have burning sensation, collapse, cold, clammy skin, weak pulse, feeble, shallow breathing, urine dark green, white eschars from lips, mouth, etc., vomiting, purging, dizziness, low temperature, contracted pupils, insensibility, comatose, death. Give quick emetic—apomorphine hypodermically—or wash out stomach with alcohol ℥ij–4 (60–120 Ml. (Cc.)) diluted with an equal quantity of water, remove at once by emetic or tube, repeat this every 5–10 minutes for 4 to 8 times; may follow with magnesium or sodium sulphate (℥j; 30 Gm.

+ water ℥viij; 240 Ml. (Cc.)), then stimulants, ether, brandy, atropine and strychnine hypodermically, digitalis, coffee, demulcent drinks (no oils or glycerin), opium, apply hot-water bottle, bag, or blankets, etc.

Incompatibles: Alcohol, bromine, soapsuds, albumin, metallic salts, antipyrine, collodion, alkalies, lime, soluble sulphates, atropine.

Synergists: Antiseptics, motor depressants.

Creosotum. Creosote, $C_7H_8O_2 + C_8H_{10}O_2$.—(Gr. κρέας, flesh, + σώζειν, to preserve—*i. e.*, its preserving properties.) (Syn., Creosot., Creasote; Fr. Créosote; Ger. Kreosotum, Kreosot.) A mixture of phenols and phenol derivatives, chiefly guaiacol, $C_7H_8O_2$, and creosol, $C_8H_{10}O_2$, obtained during the distillation of wood-tar, preferably that derived from the beech, *Fagus sylvatica* or *Fagus ferruginea,* Fagaceæ.

Manufacture: The wood-tar is distilled until one-half has passed over, the distillate separating into a *light* and a *heavy* oily layer, with an intervening aqueous acid stratum; the light oil contains eupion, etc.; to the heavy oily layer add strong Na_2CO_3 solution (to remove acid constituents) and then distil the separated oily liquid, that portion of the distillate being collected which is heavier than water; this distillate is treated with KOH solution, sp. gr. 1.12, whereby the creosote is dissolved and eupion separated, now add H_2SO_4, wash well the precipitated creosote and distil at 200–220° C. (392–428° F.); treatment with potassium hydroxide and sulphuric acid is repeated until potassium creosote solution no longer turns brown upon heating in the air. Creosote can be obtained from pyroligneous acid by saturating with sodium sulphate at 70° C. (158° F.), skimming off supernatant oily layer, distilling it and treating distillate with sodium carbonate. It varies in composition according to method and wood used, and consists chiefly of acid methylic ethers of catechol (guaiacol) and its homologues—guaiacol, creosol, phlorol (xylenol), $C_6H_{10}O$, methyl-creosol, $C_6H_{12}O_2$, methyl-guaiacol, $C_8H_{10}O_2$. It is an almost colorless, yellowish, highly refractive oily liquid, penetrating, smoky odor, burning, caustic taste, not readily brown on exposure to light, slightly soluble in water, miscible with alcohol, ether, fixed or volatile oils, neutral or faintly acid, sp. gr. 1.073; begins to distil at 195° C. (383° F.), between which and 220° C. (428° F.) 80 p. c. passes over; inflammable, burning with luminous, smoky flame. *Tests:* 1. Saturated aqueous solution 10 Ml. (Cc.), + a drop of ferric chloride T. S.—violet-blue, very transient, clouds, passing rapidly from grayish-green to muddy brown, finally a brown precipitate. 2. Add equal volume of collodion in a dry test-tube—no permanent coagulum (abs. of phenol., and so-called "coal-tar creosote"). 3. 2 Ml. (Cc.) requires 10–18 Ml. (Cc.) of normal sodium hydroxide V. S. to produce clear liquid, add 50 Ml. (Cc.) of distilled water—not cloudy (abs. of hydrocarbons and bases). *Impurities:* Phenol, coal-tar creosote, hydrocarbons and bases, cœrulignol and other high-boiling constituents of wood-tar. Should be kept in tightly-stoppered, dark amber-colored bottles. The substance known as *coal-tar creosote* has a different composition, being impure phenol, made from coal-tar, consequently is more poisonous and should not be substituted for creosote. Dose, ♏j–10 (.06–.6 Ml. (Cc.)).

Preparations.—1. *Aqua Creosoti.* Creosote Water. (Syn., Aq. Creosot.; Fr. Eau créosotée; Ger. Kreosotwasser.)

Manufacture: Agitate vigorously creosote 1 Ml. (Cc.) with recently boiled distilled water 99 Ml. (Cc.), filter until clear. Should be prepared freshly when dispensed. Dose, ʒj–4 (4–15 Ml. (Cc.)).

2. *Creosoti Carbonas.* Creosote Carbonate. (Syn., Creosot. Carb., Creosotal, Creosotum Carbonicum; Fr. Carbonate de Creosote; Ger. Kreosotcarbonat, Kreosotal.)

Manufacture: This mixture of the carbonate of various constituents of creosote, chiefly guaiacol and creosol, is made by passing a current of carbon oxychloride into solution of creosote in sodium hydroxide solution, washing separated oil with dilute sodium hydroxide solution and finally with water. It is a clear, colorless, yellowish, viscid liquid, odorless, tasteless, slight odor and taste of creosote; prolonged exposure to cold crystals of guaiacol carbonate separate, which redissolve on warming; soluble in alcohol, petroleum benzin, fixed oils, insoluble in water, miscible, with chloroform, benzene, sp. gr. 1.145–1.170; contains 90 p. c. of creosote, and is analogous to guaiacol carbonate. *Tests:* 1. Heat for a few minutes .5 Ml. (Cc.) with 10 Ml. (Cc.) of alcoholic potassium hydroxide T. S., cool—crystalline precipitate, which effervesces with acids. 2. Saturated alcoholic solution neutral, + ferric chloride T. S.—only yellow color (abs. of creosote); incinerate 1 Gm.—ash .1 p. c. Dose, ♏v–10 (.3–.6 Ml. (Cc.)), in capsule, emulsion.

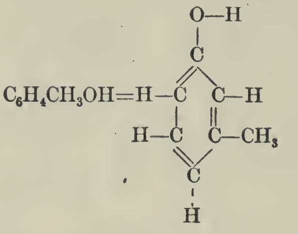
Unoff. Preps.: Mulla Creosoti Salicylata, 20 Gm., + salicylic acid 10, yellow wax 5, benzoinated suet 65, *Petroxolinum Creosoti,* 20 Gm., + oleic acid 5, liquid petroxolin 75.

Properties and Uses. — Creosote — Internally, stimulant, antiseptic, parasiticide, anæsthetic; nausea, vomiting, diarrhœa, vomiting of pregnancy and of hysteria, cholera morbus, cholera infantum, typhoid fever, dysentery, tapeworm, diabetes, polyuria, phthisis; locally—burns, chilblains, erysipelas, menorrhagia, uterine hemorrhage, leucorrhœa, puerperal metritis, fetid otorrhœa, diphtheritic sore throat, chronic empyema, toothache, gleet, ulcers, cancer, gangrene, mercurial stomatitis, glanders, ozæna, itching, lupus, warts, condylomata, as a preservative of animal tissue. The water (aqua) used in leucorrhœa, gleet, burns, ulcers, eczema, prurigo, etc. Creosote Carbonate—antitubercular, like creosote, but without its poisonous properties; it is well tolerated by the digestive system and is decomposed in the intestine, imparting a creosote odor to the breath and urine: phthisis (lessens fever and night-sweats), bronchitis, enteritis, ulceration, intestinal indigestion.

Poisoning: Same as for phenol.

Incompatibles: Strong sulphuric and nitric acid, reduces silver salts, exploding on contact with the oxide.

Cresol. Cresol.—(Syn., Cresolum, Cresylic Acid, Methylphenol, Tricresol, Oxytoluene; Fr. Cresol; Ger. Kresol, Enterol.) A mixture of isomeric cresols (C_7H_8O or $C_6H_4CH_3.OH$) obtained from coal-tar.



Manufacture: Prepared from the "phenol" distillates of coal-tar between 140–220° C. (284–482° F.), by dissolving in sodium hydroxide solution, adding water and hydrochloric or sulphuric acid to separate hydrocarbons (benzene, naphthalene, toluene, etc.) and tarry matter; to filtrate add hydrochloric acid to precipitate cresols, leaving phenol in solution, purify by solution in sodium hydroxide and distilling with hydrochloric acid at 180–200° C. (356–392° F.); consists of ortho-, meta-, and para-cresol. It is a colorless, yellowish, brown-yellow, highly refractive liquid, darker or reddish with age and exposure to light, phenol-like, sometimes empyreumatic odor, dissolves in water (50), usually forming a cloudy solution, miscible with alcohol, ether, benzene, petroleum benzin, glycerin, solutions of fixed alkali hydroxides, sp. gr. 1.034. *Tests:* 1. Saturated aqueous solution, + ferric chloride T. S.—violet-blue, neutral, slightly acid. 2. Solution of 1 Ml. (Cc.) in 60 Ml. (Cc.) of water—only slightly turbid (abs. of hydrocarbons); 90 p. c. distils at 195–205° C. (383–401° F.). *Impurities:* Hydrocarbons, phenol, etc. Should be kept dark, in well-closed containers. Dose, ♏j–3 (.06–.2 Ml. (Cc.)).

Preparation.—1. *Liquor Cresolis Compositus.* Compound Solution of Cresol. (Syn., Liq. Cresol. Co., Creolin; Fr. Soluté de Crésol composé; Ger. Liquor Cresoli saponatus, Kresolseifenlösung.)

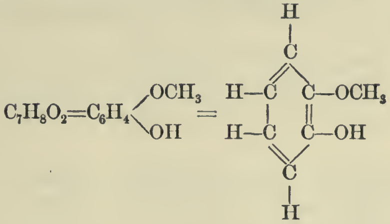
Manufacture: Heat in a tared vessel on a water-bath at 70° C. (158° F.) linseed oil 30 Gm.; dissolve potassium hydroxide 8 Gm. in water 5 Ml. (Cc.), warm, add it to linseed oil; mix thoroughly; incorporate alcohol 3 Ml. (Cc.), heat, without stirring, until a small portion is soluble in boiling water without oily drops separating; while warm add cresol 50 Gm., mix thoroughly, continue heat until clear, add water q. s. 100 Gm. It is a clear brownish-yellow liquid, oil-like consistence, slippery to touch, darkens with age, froths when mixed and shaken with water, cresol odor, alkaline reaction; may substitute sodium hydroxide 5.4 for the potassium hydroxide 8.

Properties and Uses.—Antiseptic, germicide, disinfectant; far less poisonous than phenol, the meta- being most powerful; as sodium cresylate, C_7H_7ONa, soluble in water, or by sulphonation with sulphuric acid have creolin, lysol, sapocresol, saprol, solutol, solveol, etc.

Liquor—sometimes sold as lysol, phenolin, sapocresol, etc., in 1–5 p. c. solutions as vaginal and intra-uterine douches following labor, in chronic and acute inflammations of pelvic organs, urethral and vesical irrigations in urethritis, cystitis, ophthalmia, wounds, abscesses, ulcers, sterilize instruments, hand, etc.; renders parts soft, pliable, not harsh and rough as with mercuric chloride.

4. Di-hydroxy Phenol Derivatives.

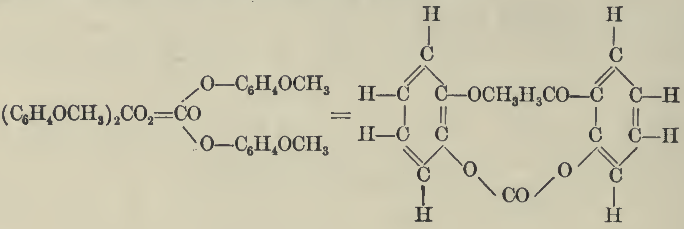
Guaiacol. **Guaiacol.** — (Syn., Guaiacolum, Ortho-di-oxybenzene-methyl-ester, Methyl-orthodioxybenzene, Methyl-pyrocatechin, Pyrocatechin (Catechol)-monomethylether; Fr. Gaïacol; Ger. Guajakol.)



$$C_7H_8O_2 = C_6H_4\begin{cases}OCH_3\\OH\end{cases}$$

Manufacture: This monomethyl ether (ortho-dihydroxybenzene) is the chief constituent of creosote, and may be obtained (1) by distilling fractionally wood-tar creosote at 200–205° C. (392–401° F.), to get crude guaiacol, treating with ammonia to remove acid compounds, distilling, dissolving the lower boiling fraction in ether, treating with alcoholic solution of potassium hydroxide, to separate potassium guaiacol, $C_6H_4KOCH_3$, which is insoluble in ether, washing well with ether, crystallizing from alcohol, decomposing with sulphuric acid, rectifying the liberated guaiacol; (2) synthetically, by heating at 170–180° C. (338–356° F.) equal molecules of pyrocatechin, potassium hydroxide, potassium methyl-sulphate—$C_6H_4(OH)_2 + KOH + KCH_3SO_4 = C_6H_4OHOCH_3 + K_2SO_4 + H_2O$, removing the resulting guaiacol by solution in alcohol or petroleum benzin, purifying by recrystallization; (3) by heating solution of metallic sodium, pyrocatechin, methyl iodide in methyl alcohol, freeing mixture from methyl alcohol, dissolving residue in sodium hydroxide solution, filtering, decomposing with hydrochloric acid; (4) by diazotizing and boiling ortho-anisidin with nitrous acid, decomposing the newly formed diazoanisol with sulphuric acid, distilling liberated guaiacol in a current of steam, redistilling, crystallizing. It is a colorless, yellowish, strongly refractive liquid or crystalline solid; odor agreeable, aromatic; darker on exposure to light and air; solid when liquefied, may remain so for some time, even at low temperature; melts at 28° C. (83° F.); dissolves in water (53), glycerin (.8), from which it separates on adding water; miscible with alcohol, chloroform, ether, acetic acid; sp. gr. 1.113; 85 p. c. distils at 200–210° C. (392–410° F.); incinerate 1 Gm.—ash .1 p. c. *Tests:* 1. Add to alcoholic solution 10 Ml. (Cc.) a drop of ferric chloride T. S.—an immediate blue color, changing to emerald-green, yellowish. 2. Shake 2 Ml. (Cc.) with purified petroleum benzin 4 Ml. (Cc.)—separates on standing into 2 distinct, clear layers; failure to separate or permanent turbidity indicates impurities (oily hydrocarbons, etc.). Should be kept dark, in well-closed containers. Dose, ♏ij–10 (.13–.6 Ml. (Cc.)).

Preparations.—1. *Guaiacolis Carbonas.* Guaiacol Carbonate. (Syn., Guaiacol. Carb., Duotal; Fr. Carbonate de Gaïacol; Ger. Guajacolcarbonat, Kohlensäure-Guajacyläther.)



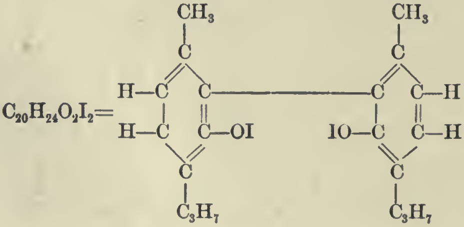
$$(C_6H_4OCH_3)_2CO_2{=}CO\begin{cases}O{-}C_6H_4OCH_3\\O{-}C_6H_4OCH_3\end{cases}$$

Manufacture: Pass slowly carbonyl chloride, $COCl_2$ (phosgene gas), into guaiacol previously dissolved in sodium hydroxide solution, forming sodium chloride and guaiacol carbonate, the latter being insoluble separates, which is washed with solution sodium hydroxide, and crystallized from alcohol. It is a crystalline powder, odorless, tasteless, slight aromatic odor and taste; soluble in alcohol (60), chloroform (1), ether (18), benzene, slightly in glycerin, fixed oils; insoluble in water, melts at 85° C. (185° F.). *Tests:* 1. Saturated alcoholic solution + ferric chloride T. S.—no bluish-green color (abs. of free guaiacol); not acid; incinerate 1 Gm.—ash .1 p. c. *Impurities:* Free guaiacol, readily carbonizable substances, etc. Dose, gr. 5–30 (.3–2 Gm.).

Unoff. Prep.: Petroxolinum Guaiacolis, 20 Gm., oleic acid 5, liquid petroxolin 75.

Properties and Uses.—For the same purposes as creosote, but is less valuable and irritating to the intestinal canal and kidneys; phthisis, external tubercle, lupus, cough, expectoration, typhoid and other fevers, local anæsthesia, neuralgia, antiseptic.

Thymolis Iodidum. Thymol Iodide.—(Syn., Thymol. Iod., Aristolum, Aristol. Dithymoldiiodide; Fr. Diiododithymol, Dithymol biiodé; Ger. Dithymoldijodid, Annidalin, Thymotol.)

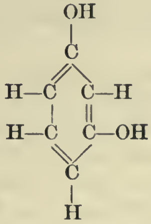


$C_{20}H_{24}O_2I_2=$

Manufacture: This is obtained by the condensation of 2 molecules of thymol, and the introduction of 2 atoms of iodine into the phenolic groups of the thymol; potassium iodide being dissolved in a solution of iodine, and the thymol in a 12 p. c. solution of sodium hydroxide, the two solutions mixed, precipitate washed and dried; it is chiefly dithymol-diiodide, and contains, when dried to constant weight, 43 p. c. of iodine. It is a reddish-yellow, bulky powder, slight, aromatic odor; insoluble in water, glycerin, slightly soluble in alcohol, readily so in chloroform, ether, collodion, fixed or volatile oils (leaving slight residue). *Tests:* 1. Heat with sulphuric acid—decomposed with separation of iodine. 2. Dried to constant weight—loses 5 p. c.; incinerate .5 Gm. at low red heat—ash 1.5 p. c. *Impurities:* Alkalies, free iodine, halogen salts. Should be kept dark, in well-closed containers.

PROPERTIES AND USES.—Antiseptic. Similar to and a substitute for iodoform in skin diseases (lupus, psoriasis, etc.), tertiary syphilis. Apply in powder or ointment, with wool fat, flexible collodion, etc.

Resorcinol. **Resorcinol,** $C_6H_4(OH)_2$.—Fr. *res*(in) + *orc*(hella) + *in* + (phen)*ol*—*i. e.*, resinous and peculiarly colored phenol substance). (Syn., Resorcin., Resorcinum, Metadihydroxybenzene; Fr. Résorcine; Ger. Resorcin.)



Manufacture: While this diatomic phenol may be made by fusing different resins, as galbanum, guaiac(um), ammoniacum, asafetida, etc., with caustic alkalies, or by the reaction of fused sodium hydroxide upon sodium metabenzene disulphonate, it is obtained mostly by heating benzene with fuming sulphuric acid (4) at 257° C. (494° F.), forming benzene metadisulphonic acid, $C_6H_4(HSO_3)_2$, which is dissolved in water, neutralized with milk of lime, decomposed with sodium carbonate, the solution of sodium benzene-metadisulphonate evaporated to dryness, residue fused 8–9 hours with sodium hydroxide (2.5), yielding sodium resorcin(ol), $C_6H_4(ONa)_2$, and sodium sulphite; boil aqueous solution of saline mass to expell SO_2, extract tar-like residue with ether, distil, leaving impure resorcinol, which is purified by sublimation and recrystallization from water. It is in colorless, nearly colorless, needle-shaped crystals, or powder, faint, peculiar odor, sweetish, bitter taste, pinkish on exposure, soluble in glycerin, ether, water (.9), hot water (.2), alcohol (.9), slightly in chloroform, melts at 110° C. (230° F.); aqueous solution (1 in 20) neutral, faintly acid;

contains 99.5 p. c. of resorcinol. *Tests:* 1. Dissolve .1 Gm. in 1 Ml. (Cc.) of potassium hydroxide T. S., add 1 drop of chloroform, heat—intense crimson color, changing to a pale straw-yellow on adding slight excess of hydrochloric acid. 2. Aqueous solution (1 in 20) gently warmed—no odor of phenol; incinerate 2 Gm.—ash .05 p. c. *Impurities:* Catechol, quinol, etc. Should be kept dark, in well-closed containers. Dose, gr. 2–5 (.13–.3 Gm.).

PREPARATIONS.—(Unoff.): *Pasta Resorcinolis Fortis:* 20 Gm., zinc oxide 20, starch 20, light liquid petrolatum 40. *Unguentum Resorcinolis Compositum,* 6 Gm., zinc oxide, bismuth subnitrate, rectified oil of birch tar, each 6, yellow wax 10, petrolatum 25, anhydrous wool fat 28, glycerin 13. *Pasta Resorcinolis Mitis;* 10 Gm., + zinc oxide 25, starch 25, light liquid petrolatum 40.

PROPERTIES AND USES.—Allied to phenol (carbolic acid); antipyretic, depressant; gastric ulcer, fermentative dyspepsia (an hour after food), vomiting, cholera infantum, diarrhœa, rheumatism, typhoid fever, pneumonia, scarlatina, pleurisy, phthisis, cystitis, vomiting, seasickness. Solution in chronic otitis, gonorrhœa, leucorrhœa, whooping-cough, chronic aphonia, laryngeal ulcers, gangrene, morbid growths, boils, carbuncles, frostbites, ulcers, fissures, erysipelas, erythema, eczema, psoriasis, herpes, alopecia, chancres, papilloma, myomas, diphtheria; as the basis of dyes—resorcin-blue, -brown, -green, etc.

Poisoning: Same as for phenol (carbolic acid).

Acidum Salicylicum. Salicylic Acid, $HC_7H_5O_3$, *official.*—(Syn., Acid. Salicyl., Ortho-oxybenzoic Acid; Fr. Acide salicylique; Ger. Salicylsäure.) This acid (orthohydroxybenzoic) exists naturally in combination in various plants (gaultheria, betula, etc.)—the best, but generally is prepared synthetically—least expensive, most popular. It may be obtained (1) by fusing salicin with potassium hydroxide; (2) by heating (saponification) oil of gaultheria with potassium hydroxide until all methyl alcohol is given off, decomposing the potassium salicylate with hydrochloric acid; (3) by saturating phenol with sodium hydroxide, producing sodium phenolate (carbolate), C_6H_5ONa, drying this compound and treating it with carbon dioxide—$C_6H_5ONa + CO_2 = NaC_6H_5CO_3$; put this in retort, heat to 130° C. (226° F.) and pass into it carbon dioxide, thereby converting it into sodium salicylate, $NaC_7H_5O_3$, which is dissolved in water, decomposed with hydrochloric acid, drained, washed with cold water, dissolved in boiling water, yielding crystals upon cooling; purify by dissolving in diluted alcohol, decolorizing with animal charcoal, recrystallizing. It is in fine prismatic needles, bulky, crystalline powder; yellowish, pinkish; slight gaultheria-like odor; sweetish, acrid taste; permanent; synthetic—white and odorless; soluble in water (460),

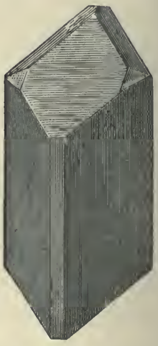


FIG. 470.—Salicylic acid crystal.

boiling water (15), alcohol (2.7), chloroform (42), ether (3), benzene (135), oil of turpentine (52); acid reaction, melts at 156° C. (313° F.); contains 99.3 p. c. of $HC_7H_5O_3$; 138 grains correspond to 169 grains of oil of gaultheria. *Tests:* 1. Saturated aqueous solution + ferric chloride T. S.—bluish-violet, violet-red. 2. Incinerate 1 Gm.—ash .1 p. c. 3. Dissolve 1 Gm. in excess of cold sodium carbonate T. S., + ether (1), agitate—evaporated ethereal residue, if any, should be free from phenol odor. *Impurities:* Iron, phenol, hydrochloric acid, coloring matter, organic substances. Dose, gr. 5–20 (.3–1.3 Gm.).

Preparations.—(Unoff.): *Glycerogelatinum Acidi Salicylici,* 10 p. c., + glyc. gelatin 20, glycerin 35, dist. water 35. *Stili Acidi Salicylici Dilubiles,* 10 p. c., + tragacanth 5, starch 30, white dextrin 35, sugar 20, dist. water q. s. *Mulla Acidi Salicylici,* 10 p. c., + benzoinated suet 80, benzoinated lard, 10. *Collodium Salicylici Compositum,* 11 Gm., fldext. of cannabis 10, flexible collodion q. s. 100. *Pulvis Antisepticus,* .5 p. c., + phenol .1, eucalyptol .1, menthol .1, thymol .1, zinc sulphate 12.5, boric acid 86.6.

Properties.—Antiseptic, antipyretic, antiperiodic, stimulant, diuretic, cardiac depressant. Small doses stimulate the stomach, heart, respiration; large doses derange stomach, causing nausea, vomiting, reduce respiration, heart action, temperature, and arterial tension. By gastro-intestinal secretions converted into sodium salicylate, and as such enters circulation; it is eliminated by kidneys and skin mainly as salicyluric acid.

Uses.—Rheumatic fever, migraine, sciatica, diabetes, cystitis, diphtheria; externally—warts, corns, excess of epidermis.

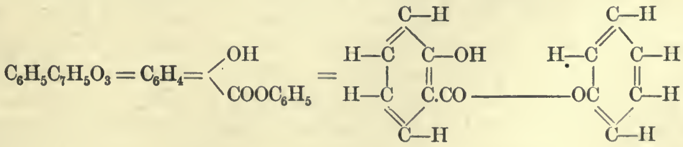
Salicylism is the result of excessive doses of salicylates, and resembles *cinchonism* from quinine. It is manifested by headache, deafness, ringing in the ears, sweating, weak pulse and respiration, nausea, delirium, vomiting, etc., and can be prevented by preceding each dose with a small quantity of alcoholic stimulant.

Poisoning: Give emetics, diffusible stimulants, atropine, strychnine, artificial heat. Same as for acetanilid.

Incompatibles: Arterial and cerebral stimulants: alkalies, mineral acids, metallic salts (especially ferric), spirit of nitrous ether.

Synergists: Phenol (carbolic acid) derivatives, anæsthetics, cardiac and cerebral depressants.

Phenylis Salicylas. Phenyl Salicylate, $C_{13}H_{10}O_3$.—(Syn., Phenyl. Salicyl., Salol; Fr. Salicylate de Phénol (Phényle); Ger. Phenylum salicylicum, Phenylsalicylat, Salolum, Salicylsäurephenylester.)



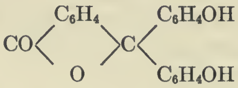
$$C_6H_5C_7H_5O_3 = C_6H_4 = \begin{cases} OH \\ COOC_6H_5 \end{cases}$$

Manufarture: This phenylester of salicylic acid may be obtained by several processes: 1, Treat sodium phenol(ate) + sodium salicylate with a dehydrating agent, as phosphorus oxychloride, or with a slow current of phosgene (carbonyl chloride)—$2C_6H_5ONa + 2C_6H_4(OH)CO_2Na + POCl_3 = 2C_6H_4(OH)CO_2C_6H_5 + 3NaCl + PO_3Na$; dissolve resulting salol in alcohol, crystallize; 2, heat salicylic acid in an atmosphere of carbon dioxide—(1) $2HC_7H_5O_3$ + heat $= (C_6H_4CO_2H)_2O + H_2O$. (2) $(C_6H_4CO_2H)_2O + C_6H_5C_7H_5O_3 + CO_2$. It is changed first into its anhydride and then into phenyl salicylate; dissolve in alcohol, crystallize. It is a white, crystalline powder, aromatic odor, characteristic taste, soluble in chloroform, ether, benzene, fixed or volatile oils, water (6670), alcohol (6), melts at 42° C. (108° F.). *Tests:* 1. Alcoholic solution (1 in 20) + diluted ferric chloride T. S.—violet color. 2. Dissolve .2 Gm. in 2 Ml. (Cc.) of hot sodium hydroxide T. S., acidify with hydrochloric acid—salicylic acid separates and phenol odor recognized; incinerate 2 Gm.—ash .05 p. c. *Impurities:* Uncombined phenol or salicylic acid, free acids, chloride, sulphate. Should be kept cool, in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.), pill, capsule, emulsion, or milk.

PROPERTIES.—Antiseptic, antipyretic, antirheumatic.

USES.—Rheumatism, neuralgia, lancinating pains, diarrhœa, dysentery, cholera, ulcers, ozæna, diphtheria, gonorrhœa, otorrhœa, vesical catarrh, fermentative dyspepsia, typhoid fever, cystitis, substitute for iodoform in surgery. Salol in the small intestine splits into phenol 36 p. c. and salicylic acid 64 p. c., consequently salol is more dangerous than salicylic acid from the presence of phenol, which latter colors the urine dark. Death has been occasioned by gr. 15 (1 Gm.), and by gr. 120 (8 Gm.), in each case signs of phenol- (carbolic acid) poisoning being present.

Phenolphthaleinum. Phenolphthalein, $C_{20}H_{14}O_4$.—(Syn., Phenolphthal., Dihydroxyphthalophenone, Dioxythiphenylphthalide, Paraphthalein; Fr. Phénolphtaléine; Ger. Phenolphthalein.)



$$CO\left\langle\begin{matrix}C_6H_4\\ O\end{matrix}\right\rangle C\left\langle\begin{matrix}C_6H_4OH\\ C_6H_4OH\end{matrix}\right.$$

Manufacture: This dibasic phenol derivative is obtained by heating phenol (10), phthalic anhydride (5), and sulphuric acid (4) at 120° C. (248° F.) for 10 hours, boiling product with water, dissolving residue in sodium hydroxide solution, precipitating phenolphthalein with acetic acid; purify by washing, dissolving in alcohol, boiling with animal charcoal, reprecipitating with water. It is a white, faintly yellowish-white, crystalline powder, odorless, tasteless, permanent, soluble in alcohol (13), ether (70), solutions of alkali hydroxides and carbonates with red color (decolorized by excess of acids or heating with zinc dust), almost insoluble in water, melts at 253° C. (487° F.);

incinerate 2 Gm.—ash .05 p. c. *Impurities:* Heavy metals, fluorane, resinous substances, etc. Dose, gr. 1.5–3 (.1–.2 Gm.), powder, cachet, capsule, pill; Gr. 8(.5 Gm.) given with safety in obstinate cases, but gr. 15 (1 Gm.) have poisoned. With sugar and vanilla as proprietary *Purgen*, etc.

PREPARATION.—(Unoff.): *Trochisci Phenolphthaleini*, 1 gr., + acacia 1.5, sugar 13, vanillin .003, carmine .001, water q. s.

PROPERTIES AND USES.—Purgative, with no other apparent physiological action; indicator in volumetric analysis.

Trinitrophenol. Trinitrophenol, $C_6H_2(OH)(NO_2)_3$.—(Syn., Trinitrophen., Picric Acid, Acidum Picricum (Carbozoticum), Carbozotic (Nitrophenisic) Acid; Fr. Acide picrique (carbazotique, nitroxaothique); Ger. Pikrinsäure, Trinitrocarbolsäure.)

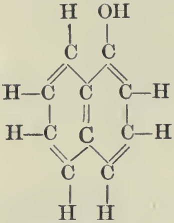
Manufacture: Formerly by action of nitric acid on indigo, silk, leather, wool, aloes, benzoin, salicin, etc.; now by mixing phenol and sulphuric acid equal parts, and, after phenolsulphonic acid forms, adding nitric acid, constantly stirring, crystallizing; may purify by removing adhering acid in a centrifuge, dissolving in sodium hydroxide solution, decomposing sodium picrate with hydrochloric acid, crystallizing, recrystallizing. It is in pale yellow, rhombic prisms, scales, odorless, intensely bitter taste; explodes when heated rapidly, or subjected to percussion; soluble in water (78), boiling water (15), alcohol (12), chloroform (35), ether (65), benzene (10); aqueous solution acid, melts at 122° C. (252° F.). *Tests:* 1. Aqueous solution (1 in 100) yellowish, darker with alkalies, red with ammonium sulphide T. S. or solution of an alkaline cyanide. 2. Dissolve 2 Gm. in 50 Ml. (Cc.) of benzene—the washed and dried insoluble residue .2 p. c. *Impurities:* Sulphate, etc. For safety in transportation usually mixed with 20 p. c. of water, and before applying tests should be dried to constant weight over sulphuric acid. Should be kept cool, remote from fire, in well-stoppered bottles. Dose, gr. ½–2 (.03–.13 Gm.); ammonium picrate (best salt), gr. ½ (.03 Gm.), ter die.

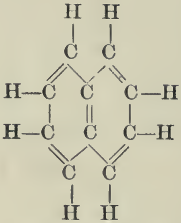
PROPERTIES AND USES.—Antiseptic, analgesic, antiperiodic, parasiticide, poisonous; solution locally in fungous endometritis, erysipelas, lymphangitis, fissured nipples, burns, scalds (1 + alcohol 10, + water 730); solution in water (1 in 100) precipitates (test) alkaloids (except aconitine, caffeine, cocaine, coniine, hyoscyamine, morphine, theobromine); popular yellow dye, modified into green with indigo or Prussian blue.

Poisoning: Imparts color to urine and all tissues, produces low temperature, weakness, vomiting, purging, collapse, convulsions, death; increases white but partly dissolves red blood corpuscles.

5. NAPHTHALENE DERIVATIVES.

Betanaphthol. Betanaphthol, $C_{10}H_7OH$.—(Gr. β, second letter of alphabet—Beta + νάφθα; L. *naphth*(a) + *ol*(eum)—*i. e.*, second of several isomeric compounds from this origin.) (Syn., Betanaph., Naphthol, Naphtol, Beta-mono-hydroxy-naphthalene, Iso-naphtol; Fr. β-Naphthol; Ger. Naphtholum.)


Betanaphthol, $C_{10}H_7OH$.


Naphthalene, $C_{10}H_8$.

Manufacture: This monohydroxyphenol of the naphthalene series occurring in coal-tar usually is prepared artificially from naphthalene by heating it with sulphuric acid to form α- and β-naphthalenesulphonic acids, $C_{10}H_7HSO_3$, the former, produced at about 90° C. (194° F.), being converted into the latter at higher temperature; dissolve in water, saturate with milk of lime to form calcium naphthalenesulphonates which crystallize out; dissolve this in water and decompose by sodium carbonate to get corresponding sodium salts, now fuse with sodium hydroxide, yielding sodium naphthol and sodium sulphite, when the former may be treated with hydrochloric acid to form sodium chloride and betanaphthol, which is purified by sublimation and recrystallization from water; it bears the same relation to naphthalene as does phenol to benzene. It is in colorless, pale buff, shining crystalline laminæ, or white, yellowish crystalline powder, faint phenol-like odor, pungent taste, permanent, soluble in water (1000), boiling water (80), alcohol (.8), chloroform (17), ether (1.3), glycerin, olive oil, alkali hydroxide solutions, melts at 121° C. (250° F.), sublimes, volatilizes with alcohol, water; hot saturated aqueous solution neutral. *Tests:* 1. Cold saturated aqueous solution + ammonia water—faint bluish fluorescence; + ferric chloride T. S.—greenish, slowly separating whitish flakes, brownish on heating. 2. Add .1 Gm. to 5 Ml. (Cc.) of aqueous solution of potassium hydroxide (1 in 4), + 1 Ml. (Cc.) of chloroform, warm gently—aqueous layer blue, green, brown, incinerate 2 Gm.—ash .05 p. c. · *Impurities:* Naphthalene, alphanaphthol, organic substances. Should be kept dark, in well-closed containers. Dose, gr. 2–5 (.13–.3 Gm.).

Preparations.—(Unoff.): *Pasta Betanaphtholis*, 10 Gm., + precipitated sulphur 50, petrolatum 20, soft soap 20. *Petroxolinum Betanaphtholis*, 10 Gm., + liquid petroxolin 90.

Properties and Uses.—Antiseptic, antifermentative, deodorizer, stimulant, typhoid fever, ozæna, eczema, prurigo, herpes, favus, conjunctivitis, chronic laryngitis, otitis, ringworm, psoriasis, scabies, abscesses, acne, diarrhœa, dysentery. Apply in alcoholic solution, 1–2 p. c., or ointment, 10–15 p. c.

Allied Product:

1. *Naphthalenum. Naphthalene,* $C_{10}H_8$, official 1890–1910.—Obtained from coal-tar and purified by crystallization, being formed by the union of 2 benzene groups, so as to have 2 carbon atoms in common; when coal-tar is distilled between 180–250° C. (356–482° F.) and the distillate has deposited gradually a dark crystalline substance, chiefly impure naphthalene, it is treated successively with NaOH and H_2SO_4 (to remove acid and basic by-products—phenols, aniline, etc.), then purified by distillation in the presence of steam, further heating with H_2SO_4 and distilling. It is in colorless, shining, transparent laminæ, strong characteristic odor of coal-tar, burning, aromatic taste, slowly volatilized and brownish by exposure, insoluble in water, soluble in alcohol (13), freely in ether, chloroform, carbon disulphide, fixed and volatile oils. *Test:* 1. On shaking with sulphuric acid should remain colorless, and if heated 5 minutes should not acquire more than a pale reddish tint (abs. of impurities derived from coal-tar). Antiseptic, expectorant, parasiticide, vermifuge; intestinal catarrh, inflammation, typhoid fever, diarrhœa, whooping-cough, chronic bronchitis, bronchorrhœa, wounds, ulcers, scabies, dysentery, prurigo. Dissolved in alcohol and used like spirit of camphor, for sprains, contusions. Should be kept in well-stoppered, amber-colored bottles. Dose, gr. 2–15 (.13–1 Gm.).

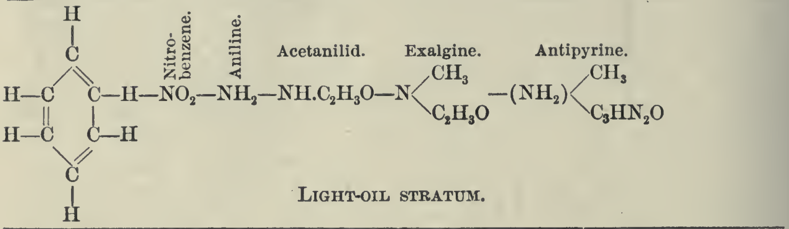
6. Benzene Derivatives containing Nitrogen.

By analysis the exact molecular composition of many vegetable alkaloids has been determined, and inasmuch as many of these are troublesome to extract, hence expensive to the consumer, experimenters have interested themselves in trying to reproduce artificially such substances by joining their elements synthetically in the proper proportions. While this has often been found impracticable, yet the building, substitution, and replacement of elements with such an end in view have been remarkably successful. The greatest satisfaction has resulted from starting with basal products which contain the necessary elements in a condition or form susceptible of ready displacement. The cheapest and most acceptable base so far discovered is coal-tar, of which mention has been made in several connections. In experimenting with coal-tar, myriads of approximate principles or alkaloids have been formed, many of which, although not having the exact formulæ, are identical in most respects with its vegetable prototype. Beginning with coal-tar—in the first place it is distilled to obtain benzene, which is converted by nitric acid into nitrobenzene, and into this nascent hydrogen is passed, producing aniline or phenylamine, $C_6H_5NH_2$:

(1) $C_6H_6 + HNO_3 + C_6H_5NO_2 + H_2O$. (2) $C_6H_5NO_2 + 6H = C_6H_5NH_2 + 2H_2O$.

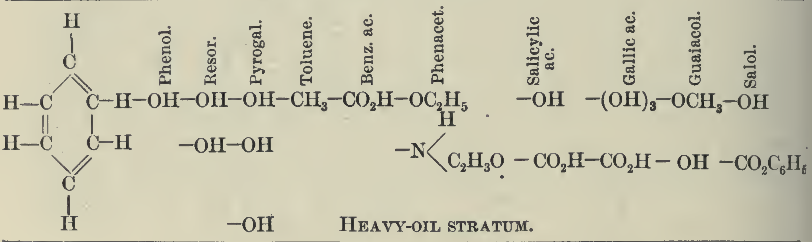
Aniline (Ar. *anil,* indigo—*i. e.,* its brilliant violet and indigo dyes) is therefore the assumed basal product, which is a colorless, oily, alkaline liquid, peculiar aromatic odor, bitter taste, boiling at 181° C.

(359° F.), insoluble in water, poisonous; it is an amine acting like a base, hence combines with acids, forming well-defined salts.


Nitro-benzene.
Aniline.
Acetanilid.
Exalgine.
Antipyrine.
C–H–NO₂–NH₂–NH.C₂H₃O–N(CH₃)(C₂H₃O) –(NH₂)(CH₃)(C₃HN₂O)

LIGHT-OIL STRATUM.

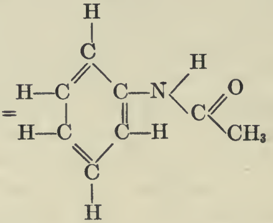
ACID-AQUEOUS STRATUM.


Phenol.
Resor.
Pyrogal.
Toluene.
Benz. ac.
Phenacet.
Salicylic ac.
Gallic ac.
Guaiacol.
Salol.
C–H–OH–OH–OH–CH₃–CO₂H–OC₂H₅ –OH –(OH)₃–OCH₃–OH
–OH–OH
–N(H)(C₂H₃O) –CO₂H–CO₂H–OH –CO₂C₆H₅
–OH

HEAVY-OIL STRATUM.

Acetanilidum. Acetanilid.—(Fr. *acet*(ic) + *anil*(ine) + *id*(*e*)—*i. e.*, referring to its components.) (Syn., Acetanil., Acetanilide, Antifebrin(um), Phenylacetamide, Antifebrinum, Antifebrin, Acetylamidobenzene; Fr. Acétanilide; Ger. Antifebrin.)

$C_6H_5NH,CH_3CO=$



Manufacture: This monoacetyl derivative of aniline is obtained from the latter by replacing its hydrogen by the acetic radical—acetyl, C_2H_3O—by boiling together aniline and glacial acetic acid for 1–2 days; now distil, collect portion passing over at 295° C. (563° F.), and when cool acetanilid congeals—$C_6H_5NH_2 + HC_2H_3O_2 = C_6H_5\text{-}NHC_2H_3O + H_2O$; purify by repeated crystallization from water. It is in colorless, shining, micaceous, crystalline laminæ or powder; odorless; slightly burning taste; permanent, melts at 112° C. (234° F.); soluble in water (190), boiling water (20), alcohol (3.4), boiling alcohol (.6), chloroform (3.7), ether (17), benzene (47), glycerin (5); aqueous solution neutral. *Tests:* 1. Boil .1 Gm. with potassium hydroxide T. S. (5)—characteristic aniline odor, + chloroform (1), heat—disagreeable odor of poisonous phenylisocyanide. 2. Boil .1 Gm. with hydrochloric acid (2)—clear solution, + aqueous solution of phenol, 1 in 20, (3), + filtered, saturated solution of chlorinated lime (5)—brownish-red, turning deep blue with ammonia water. 3. Aqueous solution + bromine T. S.—white crystalline precipitate; incinerate 2 Gm.—ash .05 p. c. *Impurities:* Aniline salts, allied, and readily carbonizable substances. Dose, antipyretic, gr. 5 (.3 Gm.), anodyne, gr. 1–2 (.06–.13 Gm.), in pill, tablet, capsule, or in alcohol, then diluted in water; may repeat every 4 hours.

Preparation.—(Unoff.): *Pulvis Acetanilidi Compositus:* acetanilid 70 Gm., caffeine 10, sodium bicarbonate 20, dose, gr. 5–10 (.3–.6 Gm.).

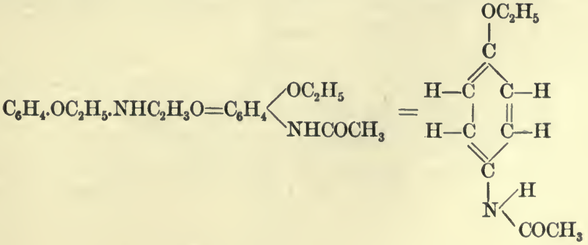
Properties.—Antipyretic, analgesic, antispasmodic, diuretic (increases excretion of urea and uric acid), diaphoretic. Small doses cause quietness; if large have headache, weakness, ringing in ears, a peculiar cyanosis, somnolence, mydriasis, temperature falls, slow respiration, feeble, irregular pulse, vomiting, profuse sweat, coma, collapse, general paralysis, dark urine, oxygen-carrying power of the blood is diminished, and corpuscles may be destroyed; blue color due to reduction of hæmoglobin to methæmoglobin in the blood. In the system acetanilid breaks up into acetic acid and aniline, and this latter oxidizes into paramidophenol. Action is chiefly on heart, liver, and kidneys, causing fatty degeneration; continued use is highly injurious.

Uses.—Phthisis, typhoid fever, hyperpyrexia, sthenic fevers, gastralgia, locomotor ataxia, rheumatism, sciatica, lumbago, neuralgia, gangrene, cancer, headache, insomnia, epilepsy, whooping-cough. There are many proprietary preparations containing 50–90 p. c. of acetanilid with sodium bicarbonate, ammonium or sodium bromide, salicylic acid, etc.

Poisoning: Have sweating, depression, slow breathing, irregular pulse, collapse, vomiting, cyanosis, prostration, death. Empty stomach, place in recumbent position, loosen clothing, plenty fresh air (for cyanosis), give diffusible stimulants (brandy, whisky, alcohol, ammonia, ether injections), coffee, atropine, strychnine (hypodermic), heat to feet and body, oxygen inhalations, rub skin, castor oil.

Incompatibles: Caustic soda and potash, chloroform.

Acetphenetidinum. Acetphenetidin. — (Syn., Acetphen., Phenacetin, Phenacetinum, Para-acetphenetidin, Para-ethoxyacetanilide; Fr. Amido-acetique de-l'amido-phénetol; Ger. Phenacetin.)



$$C_6H_4.OC_2H_5.NHC_2H_3O = C_6H_4 \begin{matrix} \diagup OC_2H_5 \\ \diagdown NHCOCH_3 \end{matrix} =$$

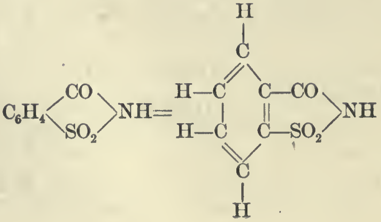
Manufacture: This monoacetyl derivative of para-amidophenetol is obtained by acting on phenol with diluted nitric acid, producing ortho- and para-nitrophenol—$C_6H_5OH + HNO_3 = C_6H_4(NO_2)OH + H_2O$; as para-nitrophenol is non-volatile, the two are separated by distillation with steam, the residuary para- being decolorized, crystallized and treated with sodium hydroxide, forming sodium nitrophenol, $C_6H_4(NO_2)ONa$, which, by heating with ethyl iodide, is converted into para-nitrophenetol—$C_6H_4(NO_2)ONa + C_2H_5I = C_6H_4(NO_2)OC_2H_5 + NaI$—which, by the action of nascent hydrogen, is converted into paraphenetidin—$C_6H_4(NO_2)OC_2H_5 + H_6 = C_6H_4(NH_2)OC_2H_5 + 2H_2O$, which, by prolonged boiling with glacial acetic acid, becomes para-acetphenetidin, similar to the conversion of aniline into acetanilid. It is in white, glistening, crystalline scales or fine powder; odorless; slightly bitter taste, faintly numbing the tongue; permanent, melts at 133° C. (272° F.); soluble in water (1310), boiling water (82), alcohol (15), boiling alcohol (2.8), chloroform (14), ether (90); aqueous solution neutral. *Tests:* 1. Boil .1 Gm. with hydrochloric acid (1), + distilled water (10), cool, filter, + a drop of potassium dichromate T. S.—ruby-red. 2. Incinerate 2 Gm.—ash .05 p. c. *Impurities:* Acetanilid, para-phenetidin, readily carbonizable substances. Dose, gr. 3–10 (.2–.6 Gm.).

Properties and Uses.—Antipyretic, analgesic, cardiac depressant, diuretic, safer than antipyrine or acetanilid; neuralgia, sciatica, locomotor ataxia, migraine, headache, hysteria, asthma, whooping-cough, epilepsy, rheumatism, chronic myelitis, arthritis, cystitis, metritis, acute neuritis, pleurisy, dysmenorrhœa. For any paroxysm of headache, etc., give gr. 3 (.2 Gm.) every hour until 3 or 4 doses are taken; it is decomposed in the system into phenetidin and amidophenol, and is eliminated chiefly by the kidneys.

Poisoning: Excessive quantity may produce vomiting, sweating, feeble and rapid pulse, collapse; treat as for acetanilid, with alcoholic stimulants, strychnine hypodermically, warmth externally, etc.

Methyl Phenacetin, $C_6H_4OC_2H_5CH_3C_2H_3O$, and *Ethyl Phenacetin*, $C_6H_4OC_2H_5C_2H_5C_2H_3O$, are also hypnotics, the first being the stronger.

Benzosulphinidum. Benzosulphinide. — (Syn., Benzo-sulphinid., Saccharin, Glusidum, Gluside, Neosaccharin, Glucusimide, Anhydro-orthosulphamidebenzoic Acid; Fr. Acide Anhydro-Orthosulfamide-Benzoique; Ger. Benzoesäuresulfimid, Zuckerin, Toluolsüss, Saccharol, Sycose.)



Manufacture: This anhydride of ortho-sulphamide-benzoic acid (benzoyl sulphonicimide) is prepared by a process involving six different steps: Take $C_6H_5CH_3$ (toluene) + H_2SO_4 + 100° C. (212° F.) = $C_6H_4(CH_3)SO_3H$ (ortho- and para-toluenesulphonic acids), which are converted into calcium and then sodium salts by sodium carbonate; act upon these with phosphorus pentachloride = ortho- and para-toluenesulphochlorides, $C_6H_4(CH_3)SO_2Cl$, cool, when para- crystallizes out; to ortho- add ammonia gas = ortho-toluenesulphamide, $C_6H_4(CH_3)SO_2NH_2$, which is oxidized with potassium permanganate = potassium ortho-sulphamidebenzoate, and this freed from precipitated manganese dioxide and decomposed by an acid splits up into its aldehyde and water, instead of separating as free ortho-sulphamidebenzoic acid. It is in white crystals, white crystalline powder, odorless or faintly aromatic, taste intensely sweet in dilute solution, soluble in water (290), boiling water (25), alcohol (31), ammonia water, alkali hydroxide solutions, sodium bicarbonate solution with evolution of carbon dioxide, slightly soluble in chloroform, ether; saturated aqueous solution acid; melts at 220° C. (428° F.). *Tests:* 1. Fuse gently 1 Gm. with sodium hydroxide (5)—ammonia vapors evolved; after these cease dissolve residue in distilled water (10), neutralize with diluted hydrochloric acid, filtrate + a drop of ferric chloride T. S.—violet. 2. Incinerate 1 Gm.—ash .5 p. c. *Impurities:* Glucose, milk-sugar, ammonium compounds, salicylic acid, carbonizable substances. Dose, gr. 1–4 (.06–.26 Gm.).

PROPERTIES AND USES.—As a substitute for sugar, in diabetic or gouty patients; antiseptic, retards action of digestive ferments, hence should be used with caution where digestion is impaired. Sodium salt (soluble saccharin, gluside, crystallose) more soluble.

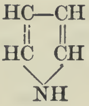
Acidum Phenylcinchoninicum. Phenylcinchoninic Acid, $C_6H_5.C_9H_5.N(COOH)$.—(Syn., Acid. Phenylcinch., Phenyl-quinoline-carboxylic Acid, Atophan; Ger. Phenylchinolincarbonsaure.) An organic acid, 2-phenylquinoline-4-carboxylic acid.

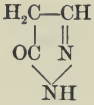
Manufacture: Heat for 3 hours on water-bath pyroracemic acid (1) and benzaldehyde (1), dissolved in alcohol, with aniline (1) previously dissolved in alcohol. It is in small, colorless needles, white or yellowish-white microcrystalline powder; odorless, or slight odor of benzoic acid; bitter taste; permanent; insoluble in water, slightly soluble in alcohol, hot water, ether, soluble in hot alcohol; melts at 210° C. (410° F.) with partial decomposition. *Tests:* 1. Saturated solution in hot diluted hydrochloric acid, + platinic chloride T. S.—reddish-brown precipitate (crystals). 2. Incinerate .5 Gm.—ash non-weighable. 3. Dissolve 1 Gm. in excess of ammonia water, evaporate to dryness on water-bath, add distilled water 20 Ml. (Cc.); filtrate + silver nitrate T. S.—white, flocculent precipitate; + lead acetate T. S.—yellowish, flocculent precipitate; + copper sulphate T. S.—green, flocculent precipitate.

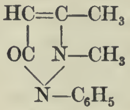
Properties and Uses.—Antirheumatic, antiseptic, analgesic, diuretic; gouty and rheumatic pains in joints or muscle sheaths, gouty and rheumatic neuralgia, neuritis, elimination of uric acid. Dose, gr. 5–20 (.3–1.3 Gm.), 4 times daily, preferably in alkaline water.

VI. Organic Bases.

Antipyrina. Antipyrine, $C_{11}H_{12}N_2O$.—(Syn., Antipyr., Phenazone, Phenazonum, Methozine, Analgesine, Dimethylphenyl-isopyrazolone, Dehydrodimethylphenylpyrazine; Fr. Analgésine, Anodynine, Parodyne; Ger. Pyrazolonum phenyldimethylicum, Antipyrin.) This is phenyldimethylpyrazolon, obtained by the condensation of phenylhydrazine with aceto-acetic ether and methylation of the product.


Pyrole


Pyrazolon


Antipyrine

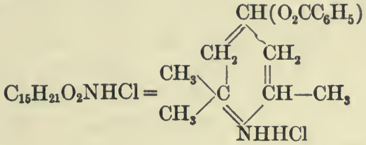
Manufacture: Aniline chloride or sulphate is treated with sodium nitrite, the resulting diazobenzene chloride or sulphate is treated with reducing agents (alkali sulphite and stannous chloride), forming phenylhydrazine, $C_6H_5HN.NH_2$, which is heated with aceto-acetic ether, $CH_3CO.CH_2CO.OC_2H_5$, producing phenylmethyl-isopyrazolone, $C_6H_5N.CO.CH{:}C(CH_3).NH$; dissolve this in methyl alcohol, heat with methyl iodide, forming a compound which treated with sodium hydroxide solution splits off hydriodic acid and separates antipyrine, as a heavy oil, that may be crystallized from toluene or ether. It is a white, almost odorless, crystalline powder, tabular crystals, slightly bitter taste, soluble in water (1), alcohol (1.3), chloroform (1), ether (43); melts at 112° C. (234° F.); aqueous solution neutral, colorless. *Tests:* 1. Aqueous solution + tannic acid T. S.—abundant white precipitate. 2. Aqueous solution (1 in 100) 12 Ml. (Cc.) + sodium nitrite .1 Gm., + diluted sulphuric acid 1 Ml. (Cc.)—deep green (isonitroso-antipyrine). 3. Aqueous solution (1 in 1000) 2 Ml. (Cc.) + a drop of ferric chloride T. S.—deep red, changing to light yellow with 10 drops of sulphuric acid. 4. Incinerate 1 Gm.—ash .1 p. c. *Impurities:* Heavy metals, etc. Should be kept in well-closed containers. Dose, gr. 2–20 (.13–1.3 Gm.).

Properties and Uses.—Antiseptic, anodyne, antipyretic, cardiac depressant, hæmostatic, diuretic, antineuralgic, analgesic, contracts the bloodvessels, migraine, locomotor ataxia, rheumatism, neuritis, urticaria, chorea, gout (arthritis), whooping-cough, tetanus, epilepsy, spasmodic laryngitis, sciatica, labor pains, diabetes, gravel, dysmenorrhœa, headache, angina pectoris, cancer, syphilitic pains, biliary and renal colic, skin diseases, eye affections, locally to ulcers and as a hæmostatic. Antipyrine resembles acetanilid very closely, and owing to its larger dose should be handled with even more caution.

Poisoning: Similar to acetanilid.

Incompatibles: Iron chloride, iodide, and sulphate, copper sulphate, iodine, arsenic iodide, sodium bicarbonate, phenol (carbolic acid), hydrocyanic acid, nitric acid, nitrites, potassium permanganate, salicylates, calomel, corrosive sublimate, spirit nitrous ether. All tannin preparations give white precipitate, and hydrated chloral decomposes it.

Betaeucainæ Hydrochloridum. Betaeucaine Hydrochloride.—(Syn., Betaeucain. Hydrochl., Eucaine Chloride, Eucaine; Fr. Chlorhydrate de Betaeucaine; Ger. Eucain B, Trimethylbenzoxypiperidinhydrochlorid.)



Manufacture: This synthetic derivative of piperidine is made by treating diacetonamine with paraldehyde, reducing product with metallic sodium to vinyldiacetonalkamine, benzoylating the latter with benzoyl chloride, dissolving resulting free base, benzoylvinyldiacetonalkamine, neutralizing with hydrochloric acid, crystallizing. It is a white crystalline powder, odorless, permanent, soluble in water (30), alcohol (35), chloroform (6); saturated aqueous solution neutral, + silver nitrate T. S.—white precipitate, insoluble in nitric acid; contains 99 p. c. of pure salt. *Tests:* 1. Dissolve .1 Gm. in distilled water (20), + a drop of ammonia water—white precipitate, dissolved by agitation; + 3 drops of ammonia water—white precipitate, dissolved by equal volume of distilled water. 2. Saturated aqueous solution + few drops of mercuric chloride T. S.—white curdy precipitate, or + few drops of a mixture of equal volumes of potassium chromate T. S. and diluted sulphuric acid—yellow curdy precipitate; incinerate .5 Gm.—ash non-weighable. *Impurities:* Cocaine, alpha-eucaine, readily carbonizable substances.

Properties and Uses. — Local anæsthetic; closely related to cocaine and tropacocaine. Has the advantage of cocaine in affecting much less the heart circulation and respiration, in not drying the corneal epithelium, nor causing mydriasis or disturbed accommodation; solutions may be sterilized by boiling water without decomposition, and are stable (dif. from cocaine); it has, however, the disadvantage of causing hyperæmia rather than contraction of mucous membranes when applied locally; largely employed in ophthalmology, 2–5 p. c. solution; for mucous surfaces, 2–5 p. c. Dose, hypodermically, ♏xv–60 (1–4 Ml. (Cc.)) of 5 p. c. solution; may use ointment (1 p. c. + olive oil 2, wool fat 7).

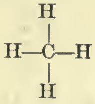
PART V.

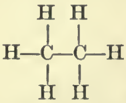
NON-PHARMACOPŒIAL ORGANIC CARBON COMPOUNDS.

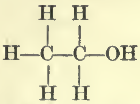
(Synthetic Remedies.)

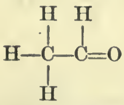
It should be borne in mind, as incidentally referred to on page 811, that the possibilities which the constructive processes of organic chemistry open to us are almost beyond limit. Not a few of those products which we have solely heretofore, and do mostly even now, depend upon crude vegetable drugs for their origin, are at the present time being built up synthetically to such perfection as often to challenge recognition of distinctive sources. Of these, the *Pharmacopœia* would recognize more than it does were it not for partial secrecy in working formula and manufacture. Quite a number are employed so universally that the present day text-book excluding them might be considered more or less incomplete. In order that the chemical relationship may be better understood they have been treated, so far as practicable, in the same ordered sequence as adopted in Part IV. Before taking them up individually, it may be well to show, by graphic formulas, the facility with which the construction and substitution of one atom or a group of atoms for others may be effected—a process which invariably results in giving each time a different substance. In order to do this, and to carry along direct relationship, some of the compounds previously treated will have to be introduced at the sacrifice of repetition, but this may be considered not in the least a disadvantage to the student.

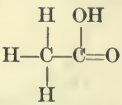
The majority of these synthetics which contain sulphur are hypnotics or sleep-producers, while those containing nitrogen are antipyretics or anodynes.

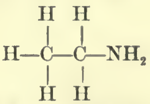

Methane=CH_4

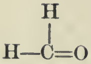

Ethane=C_2H_6


Ethyl Alcohol=C_2H_5OH


Aldehyde=C_2H_4O

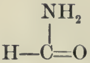

Acetic Acid=$C_2H_4O_2$


Ethylamine=$C_2H_5NH_2$



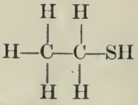
$H-\overset{H}{\overset{|}{C}}=O$

Formaldehyde=CH_2O



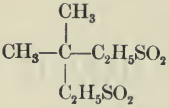
$H-\overset{NH_2}{\overset{|}{C}}=O$

Formamide=$CHO.NH_2$



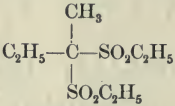
$H-\underset{H}{\underset{|}{\overset{H}{\overset{|}{C}}}}-\underset{H}{\underset{|}{\overset{H}{\overset{|}{C}}}}-SH$

Mercaptan=C_2H_5SH



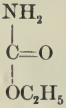
$CH_3-\underset{C_2H_5SO_2}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-C_2H_5SO_2$

Sulphonal=$C_7H_{16}S_2O_4$



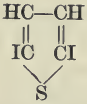
$C_2H_5-\underset{SO_2C_2H_5}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-SO_2C_2H_5$

Trional=$C_8H_{18}O_4S_2$

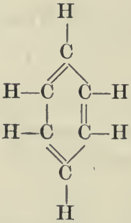


$\underset{OC_2H_5}{\underset{|}{\overset{NH_2}{\overset{|}{C}}}}=O$

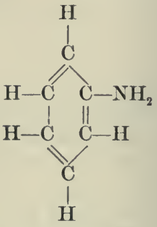
Urethane=$C_3H_7NO_2$



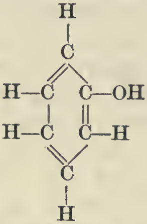
Thiophene-di-iodide=$C_4H_2I_2S$



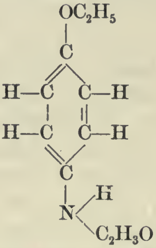
Benzene (Benzol)=C_6H_6



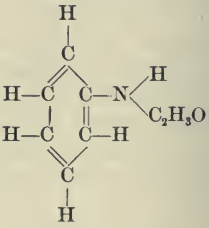
Aniline=$C_6H_5NH_2$



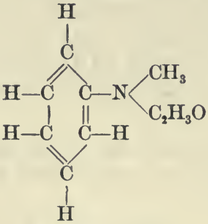
Phenol (Carbolic Acid)=
C_6H_5OH



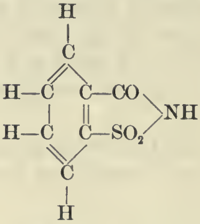
Phenacetin=$C_{10}H_{13}NO_2$



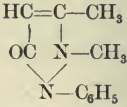
Acetanilid=C_8H_9NO



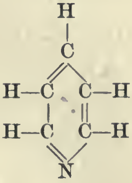
Exalgine=$C_9H_{11}NO$



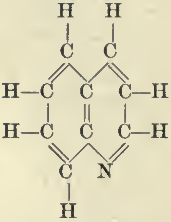
Saccharin=$C_7H_5NO_3S$



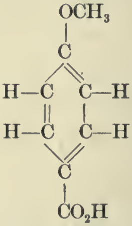
Antipyrine=$C_{11}H_{12}N_2O$



Pyridine=C_5H_5N

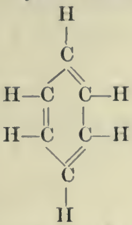


Chinoline=C_9H_7N

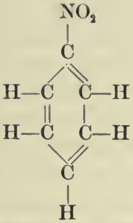


Anisic Acid=$C_8H_8O_3$

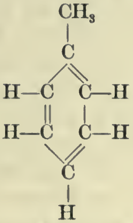
Hydrocarbons.



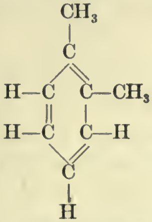
Benzene = C_6H_6



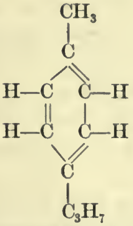
Nitro-benzene = $C_6H_5NO_2$



Toluene, Methyl-benzene = $C_6H_5.CH_3$

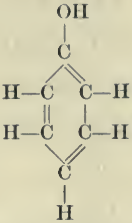


Xylene, Dimethyl-benzene = $C_6H_4(CH_3)_2$

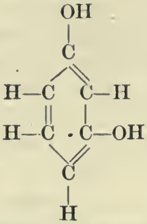


Cymene, Methyl-propyl-benzene = $C_6H_4.CH_3.C_3H_7$

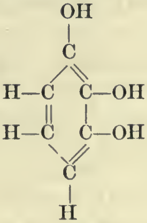
Alcohols.



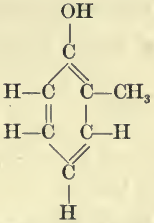
Phenol or Carbolic Acid = C_6H_5OH



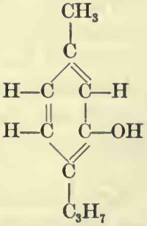
Resorcinol = $C_6H_4(OH)_2$



Pyrogallol = $C_6H_3(OH)_3$

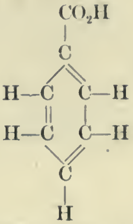


Cresol = $C_6H_4.CH_3.OH$

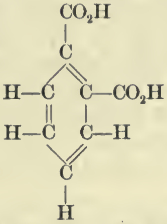


Thymol = $C_6H_3CH_3.C_3H_7OH$

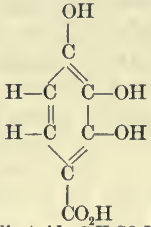
Acids.



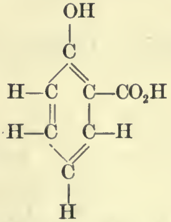
Benzoic Acid = $C_6H_5.CO_2H$



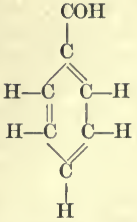
Phtalic Acid = $C_6H_4(CO_2H)_2$



Gallic Acid = $C_6H_2CO_2H.(OH)_3$



Salicylic Acid = $C_6H_4.CO_2H.OH$



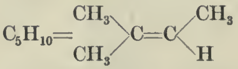
Benzaldehyde, Oil of Bitter Almond = $C_6H_5.COH$

I. FATTY SERIES (PARAFFIN OR METHANE).

(Open-chain Compounds.)

I. Hydrocarbons.

Pental. Pentalum.—Tri-methyl-ethylene, Iso-amylene.

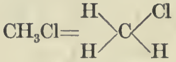


Manufacture: This is from the fifth member of the series, amylene. The amyl hydride (hydroxide) or amylic alcohol is digested with zinc chloride for 24 hours, or preferably the two are shaken occasionally together for some time with diluted sulphuric acid, thereby producing amyl sulphuric acid, which when diluted with water yields tertiary amyl alcohol and pure pental, the latter being separated by fractional distillation. It is a colorless liquid, very inflammable and volatile, not affected by light or air, insoluble in water, miscible in all proportions with alcohol, chloroform, and ether, sp. gr. 0.620, boils at 38° C. (100.4° F.).

Properties and Uses.—Anæsthetic; when inhaled acts as rapidly and safely as nitrous oxide gas, and superior to it in having a longer action and no unpleasant after-effect; acts more promptly than chloroform (1–3 minutes). Consciousness is not lost when the stage of pain-insensibility is reached; stage of exhilaration is seldom present; and drug does not lose effect by repetition; used for minor surgical operations, tooth-extraction, etc., being administered like chloroform. Dose, ♏v–10 (.3–.6 Ml. (Cc.)) internally, but for inhalation ʒij–4 (8–15 Ml. (Cc.)).

1. Halogen Derivatives.

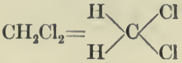
Methyl Chloride. Mono-chlor-methane.



Manufacture: Methyl alcohol, hydrochloric acid (gas), and zinc chloride are heated together under pressure in a steam digester—$CH_3OH+HCl=CH_3Cl+H_2O$; the zinc chloride simply facilitates the process; the methyl chloride has now to be purified by washing with water, acid, and alkali. It is a colorless gas, burning with a green flame, having an ether and chloroform-like odor, 1 vol. water dissolves 4 vols., while 1 vol. methyl or ethyl alcohol dissolves 35 vols.; it is also freely soluble in ether and chloroform. When cooled to —23° C. (—11.4° F.), under normal pressure, becomes a liquid which boils at —21° C. (—5.8° F.); a pressure of 5 atmospheres at normal temperature also condenses it.

Properties and Uses.—Local anæsthetic. It is kept usually in pointed glass pearls; the point being broken off, the heat of the hand is sufficient to volatilize the contents, and thus force it out as a fine spray upon the desired location. Before applying, it is well to wash the skin with soap and water to remove all fat, and to hold spray-nozzle 10 inches from the spot to be frozen. The skin soon becomes white and parchment-like, when minor surgical operations, as opening abscesses, boils, etc., may be performed painlessly. The spray should not be continued longer than 2–4 minutes, as death of tissue may result.

Methylene Bichloride. Di-chlor-methane.



Manufacture: Pass chlorine into methyl chloride (CH_3Cl), or reduce chloroform ($CHCl_3$) with zinc and hydrochloric acid. It is a colorless liquid, chloroform-like odor, insoluble in water, soluble in alcohol or ether, sp. gr. 1.354, boils at 40° C. (104° F.). It should be kept in well-stoppered bottles, in the dark, to prevent decomposition, which may also be obviated by the addition of 1 p. c. alcohol. Dose, ♏x–30 (.6–2 Ml. (Cc.)), but mostly inhaled.

Properties and Uses.—Anæsthetic; for minor operations use ʒj–2 (4–8 Ml. (Cc.)), for major ones, should not employ more than ʒiij–6 (12–24 Ml. (Cc.)).

Methylthionine Chloride. Methylthioninæ Chloridum, $C_{16}H_{18}N_3SCl$.—(*Official.*) See page 826.

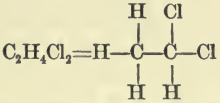
Methyl Tri-chloride. Chloroformum. Chloroform.—Tri-chlor-methane, $CHCl_3$.—(*Official.*) See page 826.

Methyl Tri-bromide. Bromoformum. Bromoform. — Tri-brom-methane, $CHBr_3$.—(*Official.*) See page 829.

Methyl Tri-iodide. Iodoformum. Iodoform. — Tri-iodo-methane, CHI_3.—(*Official.*) See page 830.

Ethyl Chloride. Æthylis Chloridum. Mono-chlor-ethane, C_2H_5Cl.—(*Official.*) See page 832.

Ethylene Bichloride. Æthyleni Bichloridum.—Ethene Chloride, Dutch Liquid.

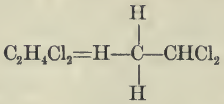


$$C_2H_4Cl_2{=}H-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{Cl}{C}}-Cl$$

Manufacture: Combine equal volumes of the unsaturated hydrocarbon ethylene (C_2H_4) and chlorine (Cl_2). It is a colorless, thin, oily, volatile liquid, sweet taste, chloroform-like odor, sp. gr. 1.26, boils at 85° C. (185° F.), soluble in alcohol, ether, sparingly in water.

Properties and Uses.—Anæsthetic. Much safer than chloroform (no collapse), also more pleasant and rapid in action, causes no excitement like ether, and recovery is more rapid. It is, however, more expensive than chloroform, and irritates the throat so much that it is used with difficulty; efficacious locally in neuralgia.

Ethylidene Chloride. Di-chlor-ethane.—Mono-chlorinated Hydrochloric Ether.

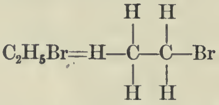


$$C_2H_4Cl_2=H-\overset{H}{\underset{H}{C}}-CHCl_2$$

This is isomeric with ethylene bichloride, which it resembles in odor; has a density of 1.198, boils at 57.5° C. (135.5° F.), and is decomposed by sulphuric acid; it is a colorless, hot, sweet, volatile liquid of chloroformic odor.

Properties and Uses.—Anæsthetic for inhalation. Acts similarly to chloroform, but is possibly a better preparation.

Ethyl Bromide. Æthylis Bromidum.—Mono-bromo-ethane, Ether Bromatus, Hydrobromic Ether.



$$C_2H_5Br=H-\overset{H}{\underset{H}{C}}-\overset{H}{\underset{H}{C}}-Br$$

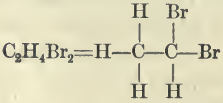
Manufacture: Distil alcohol (12) and sulphuric acid (7), gradually adding potassium bromide (12):

(1) $C_2H_5OH+H_2SO_4=C_2H_5HSO_4+H_2O$.
(2) $C_2H_5HSO_4+KBr=C_2H_5Br+KHSO_4$.

It is a colorless, light, refractive, mobile, heavy liquid, very volatile, sweet warm taste, chloroform-like odor, sp. gr. 1.445–1.450, boils at 39° C. (102° F.), miscible with alcohol, chloroform, ether, and oils, but not with water. Should be kept in the dark and in well-stoppered flasks, inasmuch as air and light decompose it into hydrobromic acid and bromine.

Properties and Uses.—Anæsthetic. It is rapid, transient, abolishing pain without loss of consciousness, depresses respiration, but is attended, as a rule, with no bad effects, as is chloroform. A few whiffs are generally sufficient to cause anæsthesia, which lasts sufficiently long for all minor surgical operations, as opening abscesses, boils, in dentistry, etc. In administering, hold the towel close to the mouth to prevent admission of air, and put the full quantity thereupon at once, which should be ʒij–6 (8–24 Ml. (Cc.)). With most anæsthetics the converse is the case. Administer on empty stomach, only one minute, do not reapply, and never use when lesions of heart, kidneys, or lungs are present.

Ethylene Bromide. Æthylenum Bromatum.—Brom-ethylene



$$C_2H_4Br_2=H-\overset{H}{\underset{H}{C}}-\overset{Br}{\underset{H}{C}}-Br$$

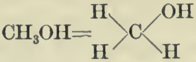
Manufacture: The unsaturated hydrocarbon ethylene (C_2H_4) is passed into bromine until saturation is effected—$C_2H_4+Br_2=C_2H_4Br_2$. It is a colorless, strongly refracting liquid, sweet taste, chloroformic odor, sp. gr. 2.170, boils at 132° C. (269° F.). Dose, ♏ij–5 (.13–.3 Ml. (Cc.)).

Properties and Uses.—In epilepsy; should not be confounded with ethyl bromide, owing to its more poisonous properties.

II. Alcohols.

2. Oxygen Derivatives.

Methyl Alcohol. Alcohol Methylicum.—(Syn., Methyl Hydroxide, Wood Naphtha or Spirit, Pyroligneous Spirit or Alcohol; Fr. Alcool (Esprit) de Bois.)



$$CH_3OH = \begin{matrix} H \\ H \end{matrix} \!>\! C \!<\! \begin{matrix} OH \\ H \end{matrix}$$

Manufacture: The aqueous portion of the distillate from the destructive distillation of wood contains 1 p. c., along with acetic acid, acetone, aldehyde, allyl alcohol, oils, etc.; this lighter portion is saturated with chalk, $CaCO_3$ (forming calcium acetate), then distilled, and all that comes over under 100° C. (212° F.) is crude wood spirit, which has to be rectified again over $CaCl_2$ and CaO. It is a thin, colorless liquid, peculiar odor, burning taste, sp. gr. 0.802. A purified product, having less odor, under the name of *Columbian Spirit* is used largely in making external remedies and those from which it is reclaimed during manufacture.

Properties and Uses.—Mostly in the arts as a substitute for (ethyl) alcohol to dissolve resins, volatile oils, alkaloids, etc.

Methylated Spirit consists of ethyl alcohol 90 p. c. + methyl alcohol 10 p. c. This is used abroad as an alcoholic solvent, owing to its being free from internal revenue tax; very poisonous.

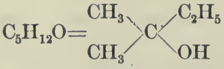
Ethyl Alcohol. Alcohol, C_2H_5OH. (*Official.*) See page 816

Denatured Alcohol. Alcohol Denaturatum.—Ger. Denaturirter Spiritus.

Manufacture: 1. Mix alcohol (180° proof) 100 gallons, methyl alcohol 10 gallons, benzin .5 gallon. 2. Mix alcohol (180° proof) 100 gallons, methyl alcohol 2 gallons, pyridine bases .5 gallon. It is a transparent, colorless, mobile, volatile liquid, characteristic burning taste, odor varying as to denaturants used. As thus made it is unfit for use in many industries, consequently the Internal Revenue Department has authorized other formulas (13) to serve special purposes, all, however, rendering the final product unsuitable for a beverage or an internal medicine, so as to be withdrawn from bond tax-free. All denaturants—methyl alcohol, benzin, pyridine bases, camphor, lye, castor oil, etc.—must conform to the Government specifications.

Properties and Uses.—Poisonous; only to be used externally as fuel, light, power, solvent in arts, etc.; shellac varnishes, photographic collodion and dry plates, lacquers from soluble cotton, resin podophyllum, acetic ether, ethyl chloride, embalming fluid, heliotropin, chewing and smoking tobacco, ether for anæsthesia, sulphomethane, fulminate of mercury, photo-engravings, transparent soap, barometers, thermometers, watches, purification of rubber, imitation leather, etc.

Amylene Hydrate. Di-methyl-ethyl-carbinol.—Tertiary Amyl Alcohol.



$$C_5H_{12}O=\begin{matrix}CH_3\\CH_3\end{matrix}>C<\begin{matrix}C_2H_5\\OH\end{matrix}$$

Manufacture: Impure amylene is treated with H_2SO_4, which forms amyl sulphuric acid; this is diluted, filtered, neutralized with milk of lime or liquor sodii hydroxide, and then fractionally distilled. It is a clear, oily liquid of a peculiar penetrating odor resembling that of a mixture of camphor and peppermint, burning taste, sp. gr. 0.815, boils at 102.5° C. (216.5° F.), dissolves in water (8), miscible in all proportions with alcohol, chloroform, ether, benzin, fixed oils, and glycerin; yields acetic acid on oxidation. Dose, ♏xv–45 (1–3 Ml. (Cc.)). May disagree with stomach, then give hypodermically.

PROPERTIES AND USES.—Hypnotic, anodyne. Has a power midway between hydrated chloral and paraldehyde. May be given in wine, fruit, syrup, or water.

III. Aldehydes.

Solution of Formaldehyde. Liquor Formaldehydi, CH_2O.—(*Official.*) See page 822.

Hexamethylenamine. Hexamethylenamina. Urotropine, $C_6H_{12}N_4$.—(*Official.*) See page 823.

Tannoform. Methylene Ditannin, $(C_{14}H_9O_9)_2CH_2$.

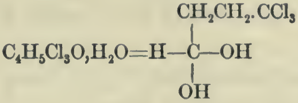
Manufacture: Dissolve tannin 5 Gm., in hot water 15 Kg., add 30 p. c. formaldehyde 3 Kg., precipitate with hydrochloric acid 15 Kg., wash precipitate. There are several tannoforms, each differing only in the purified plant extract used containing the tannin. Tannoform is a light, pinkish-white powder, soluble in alcohol. Enteritis, diarrhœa, bedsores, fetor of feet and sweat, chancres, eczema, pruritus vaginæ. Dose, gr. ½–1 (.03–.06 Gm.).

Tannalbin. Albuminis Tannas (tannic acid + albumin) and *Tannopin, Tannon* (tannic acid + hexamethylenamine), being only soluble in the duodenum (decomposed by alkalies), are valuable astringents in infantile diarrhœa, tuberculous enteritis, intestinal catarrh, etc. Dose, the former, gr. 15–60 (1–4 Gm.); the latter, gr. 5–15 (.3–1 Gm.), ter die.

Paraldehyde. Paraldehydum, $C_6H_{12}O_3$. (*Official.*) See page 823.

Hydrated Chloral. Chloralum Hydratum, C_2HCl_3O,H_2O.—(*Official.*) See page 824.

Butyl-Chloral Hydrate. Butyl-Chloral Hydras.—Chloral Butylicum, Croton-Chloral Hydrate (misnomer), Tri-chlor-butylaldehyde Hydrate.



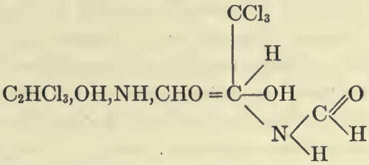
$$C_4H_5Cl_3O,H_2O=H-\overset{\displaystyle CH_2CH_2.CCl_3}{\underset{\displaystyle OH}{C}}-OH$$

Manufacture: Pass dry chlorine gas through (acetic) aldehyde, when butyl-chloral, $C_4H_5Cl_3O$, is formed, which being an oil is separated by fractional distillation; this then will unite with water to form a solid hydrate, and from this solution butyl-chloral hydrate crystallizes in white scales with a peculiar pungent, fruit-like odor, warm, bitter, nauseous taste; it is readily soluble in alcohol, ether, hot water, and glycerin, slightly in cold water, melts at 78° C. (172° F.). Dose, gr. 5–30 (.3–2 Gm.), in pills, syrup. It is well to give gr. 3–5 (.2–.3 Gm.) every 2 hours until pain is relieved or sleep produced.

Incompatibles: All alkalies.

Properties and Uses.—Hypnotic. Similar to hydrated chloral, but less certain, and by some claimed to be not so depressant to the heart. Good in facial neuralgia, migraine, headache, nausea, neuralgia —due to decayed teeth.

Choralformamide. Choralformamidum.—Chloralamide.



Manufacture: By direct union of anhydrous chloral (147) with formamide (45) at ordinary temperature, purifying resulting solid by crystallization from water or 30 p. c. alcohol. It is in shining, colorless, odorless, slightly bitter crystals, soluble in ether, glycerin, acetone, acetic ether, water (18.7), alcohol (1.3), hydrolized at 60° C. (140° F.) into components—hydrated chloral + formamide (ammonium formate), melts at 115° C. (239° F.), decomposed at higher temperature, and by warming with alkali hydroxides with separation of chloroform, not affected by diluted acids. *Impurities:* Chloral alcoholate, ethyl carbamate, formic, hydrochloric and other free acids, decomposition products, inorganic substances; should be kept in well-stoppered, amber-colored bottles. Dose, gr. 10–40 (.6–2.6 Gm.).

Properties and Uses.—Hypnotic; resembles hydrated chloral but without harmful after-effects; neither tolerance nor habit from long usage; does not relieve pain; painless insomnia, hysteria, asthma, rheumatism, spinal diseases, heart affections, chorea; owing to insolubility, absorption and effect are slow, consequently it should be dissolved in alcohol, brandy, or aromatic sulphuric acid. One of the best preventives of sea-sickness, when a cathartic just before, and gr. 30 (2 Gm.) each of this and potassium bromide on an empty stomach after going aboard ship, and a rest in bed usually affords comparative relief.

Chloralose. Anhydro-gluco-chloral, $C_8H_{11}Cl_3O_6$.

Manufacture: Heat together equal quantities of anhydrous chloral and glucose at 100° C. (212° F.) for at least an hour, treat the cooled mass with a little water, then boil with ether, distil the ether-soluble portion with water to remove chloral, then let crystallize; yield about 3 p. c. It occurs in small colorless crystals, bitter, disagreeable taste, soluble in alcohol, ether, acetic acid, hot water, and slightly in cold water; melts at 185° C. (365° F.). Dose, gr. 5–15 (.3–1 Gm.).

Properties and Uses.—Hypnotic; free from cumulative and cardiac after-effects. Causes profound sleep, in which sensibility is not lost; owing to its great bitterness should be given in capsules or cachets. Its poisonous effect resembles very much that of hydrated chloral.

Acetone. Acetonum, $(CH_3)_2CO$.—(*Official.*) See page 833.

Acetozone. Benzoylacetyl Peroxide, $(C_6H_5CO.COCH_3)O_2$.

Manufacture: By oxidizing mixture of benzaldehyde and acetic anhydride. Occurs in white shining crystals, melting at 37° C. (98° F.), soluble in water (1 : 1000—10,000, according to temperature), oil (35), slightly in alcohol, ether, chloroform. Commercial acetozone contains equal weight of an inert absorbent, and even then, owing to irritating stomach, should only be given in solutions, which, except oily, gradually decompose, especially when heated or alkali added.

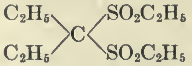
Properties and Uses.—Aqueous solution oxidizing agent, similar to hydrogen dioxide, antiseptic, germicide; diarrhœa, dysentery, typhoid (lessening tympanites, diarrhœa, odor, nervousness, temperature), tonsillitis, urethritis, abscesses, gangrene, corneal ulcers, etc. Dose, gr. 15 (1 Gm.) dissolved in warm water, 4 pints (2000 Ml. (Cc.))—entire or half within 24 hours. *Inhalant* consists of acetozone (2), chloretone (1), liquid petrolatum 197.

3. Sulphur Derivatives.

Sulphonmethane. Sulphomethanum. Sulphonal, $(CH_3)_2C(C_2H_5SO_2)_2$.—(*Official.*) See page 834.

Sulphonethylmethane. Sulphonethylmethanum. Trional, $CH_3C(C_2H_5SO_2)_2C_2H_5$.—(*Official.*) See page 834.

Tetronal. Tetronalum.—Diethyl-sulphon-diethyl-methane.



Manufacture: Like sulphonal, except that start with diethyl-ketone instead of acetone. It is in colorless, odorless, shining plates or laminæ, soluble in alcohol, ether, hot water, and cold water (450); melts at 89° C. (192° F.). Dose, gr. 15–30 (1–2 Gm.).

Properties and Uses. Hypnotic. Similar to, but much less used than sulphonal and trional.

The three last compounds or sulphones depend upon the ethyl groups for hypnotic effects, the greater their number the more powerful the action.

IV. Acids.

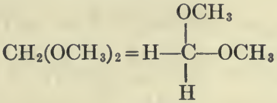
Acetic Acid.—**Acidum Aceticum,** $C_2H_4O_2$.—(*Official.*) See page 835.

Trichloracetic Acid. Acidum Trichloraceticum, $HC_2Cl_3O_2$.—(*Official.*) See page 837.

Lactic Acid. Acidum Lacticum, $C_3H_6O_3$.—(*Official.*) See page 842.

V. Ethers.

Methylal.—Methylene-dimethyl Ether.



$$CH_2(OCH_3)_2 = H-\begin{array}{c} OCH_3 \\ | \\ C \\ | \\ H \end{array}-OCH_3$$

Manufacture: Distil together methyl alcohol, sulphuric acid, and manganese dioxide, by which process the methyl alcohol is oxidized; caustic potash may be added to the distillate to separate the methyl formate. This is a mobile, colorless, volatile liquid, odor like chloroform and acetic ether, burning, aromatic taste, soluble in alcohol, ether, oils, and water (3), sp. gr. 0.855, boils at 42° C. (107.6° F.). Dose, ♏xxx–90 (2–6 Ml. (Cc.)), in emulsion, or syrup and water.

Properties and Uses.—Anæsthetic, hypnotic, narcotic; asthma, colic, angina, tetanus.

Ethyl Ether. Æther.—Ethyl Oxide, $(C_2H_5)_2O$.—(*Official.*) See page 843.

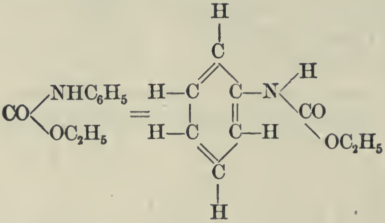
Ethyl Nitrite. Nitrous Ether, $C_2H_5NO_2$.—(*Official.*) See page 845.

Amyl Nitrite. Amyl Nitris, $C_5H_{11}NO_2$.—(*Official.*) See page 846.

4. UREA DERIVATIVES.

Ethyl Carbamate. Æthylis Carbamas. Urethane, $C_2H_5NH_2CO_2$.—(*Official.*) See page 847.

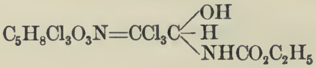
Euphorin. Phenyl Urethane.



Manufacture: By the interaction of chlor-ethyl-formate and aniline. It is a white crystalline powder, faint aromatic odor, clove-like after-taste, soluble in alcohol, ether, hydro-alcoholic solutions. Dose, gr 2–10 (.13–.6 Gm.).

Properties and Uses.—Antipyretic, analgesic, antirheumatic; as a substitute for iodoform.

Ural. Uralium.—Chloral Urethane, Uraline.

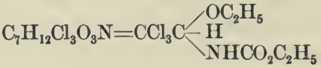


$$C_5H_8Cl_3O_3N=CCl_3C\left\langle\begin{matrix}OH\\H\\NHCO_2C_2H_5\end{matrix}\right.$$

Manufacture: Mix together hydrated chloral and urethane, on adding HCl they unite into a solid which is insoluble in cold water, treat with H_2SO_4, wash with water; this compound is decomposed by hot water into its two components, soluble in alcohol or ether. Dose, gr. 10–40 (.6–2.6 Gm.).

Properties and Uses.—Hypnotic; cough, angina, insomnia.

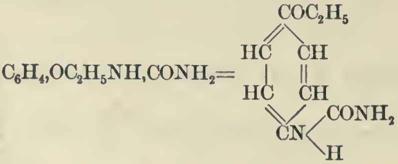
Somnal. Ethylated Chloral Urethane.



$$C_7H_{12}Cl_3O_3N=CCl_3C\left\langle\begin{matrix}OC_2H_5\\H\\NHCO_2C_2H_5\end{matrix}\right.$$

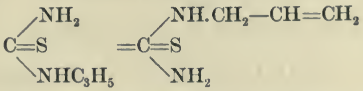
This is an alcoholic solution of ural, or a union of alcohol, hydrated chloral, and urethane. It is hypnotic in doses ♏x–40 (.6–2.6 Ml. (Cc.)).

Sucrol. Dulcin.—Para-phenetol-carbamide, Para-ethoxy-phenyl Urea.



Manufacture: Act upon para-phenetidine with carbonyl chloride to form dipara-phenetol-carbamide; heat this in steam digester with urea to 160° C. (320° F.). This compound crystallizes from water in shining needles, sweet taste, soluble in hot water (150), cold water (800), alcohol (25). It is 200 times sweeter than sugar, for which it is used in diabetes.

Thiosinamin. Allyl-thio-urea.—Allyl-sulpho-urea.



Manufacture: Act on allyl-sulphocyanate (mustard oil, C_3H_5NCS) with ammonia. Occurs in colorless, rhombic crystals, bitterish, soluble in water, alcohol, ether, melts at 74° C. (165° F.), garlic odor. Dose, gr. ½–7 (.03–.5 Gm.), by injection, repeated every 3–4 days. Poisonous.

PROPERTIES AND USES.—Inject subcutaneously for lupus, tuberculous diseases; causes absorption of exudate, corneal opacities.

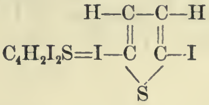
Veronal. Veronalum. Diethylmalonylurea. Diethylbarbituric Acid, $C_8H_{12}N_2O_3$.

Manufacture: By interaction of diethylmalonic acid and urea. Occurs as a white, odorless, bitterish, crystalline powder, melting at 191° C. (376° F.), soluble in hot water (12), and forms soluble salts.

PROPERTIES AND USES.—Hypnotic—insomnia, especially that accompanying hysteria, neurasthenia, and mental disturbances. Dose, gr. 5–15 (.3–1 Gm.), in hot water, tea or milk, wafers, capsules, followed by warm drink of some kind.

5. THIOPHENE DERIVATIVES = C_4H_4S.

Thiophene-Di-iodide.—Di-iodo-thiophene.



Manufacture: By the action of iodine on thiophene (C_4H_4S, a product from benzene) in the presence of mercuric oxide. It is in colorless, volatile crystals, aromatic odor, soluble in ether, chloroform, hot alcohol, insoluble in water; melts at 40.5° C. (104.9° F.); contains 75.5 p. c. iodine and 9.5 p. c. sulphur.

PROPERTIES AND USES.—Antiseptic. As a substitute for iodoform.

Sodium Thiophene-sulphonate, C_4H_3S,SO_3Na.—This is a white crystalline powder, containing 33 p. c. sulphur, with a feeble, disagreeable odor, and used like the preceding.

II. AROMATIC (BENZENE) SERIES, C_6H_6.

(CLOSED-CHAIN COMPOUNDS.)

6. TERPENES.

Terebene. Terebenum, $C_{10}H_{16}$.—(*Official.*) See page 73.

Terpin Hydrate. Terpini Hydras, $C_{10}H_{16}3H_2O$.—(*Official.*) See page 72.

7. Phenol Derivatives.

Phenol. Acidum Carbolicum, C_6H_5OH.—(*Official.*) See page 849.

Menthol. Menthol, $C_{10}H_{20}O$.—(*Official.*) See page 510.

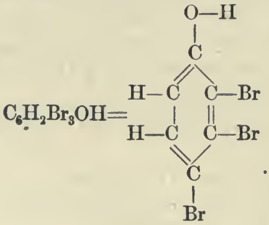
Salvarsan. Arsenphenol-amin hydrochloride — Arsenobenzol — "606"-3-diamido-4-dihydroxy-1-arseno-benzene hydrochloride, $HCl.NH_2.OH,C_6H_3.As{:}As.C_6H_3.OH.NH_2.HCl + 2H_2O$., corresponding to 31.57 p. c. arsenic (As).

Manufacture: By the nitration of p-oxy-phenyl-arsenic acid, and subsequent reduction and condensation of the resulting nitro-phenyl-arsenic acid. It is a yellow, crystalline, hygroscopic powder, unstable in air, soluble in water with acid reaction; solution (1) with solution of sodium hydroxide (2) gives precipitate of free base, as does solution of sodium carbonate, insoluble in excess; aqueous solution not affected by dilute mineral acids, reduces alkaline solution of potassium permanganate when heated, liberating ammonia gas. Dose, gr. 5–9 (.3–.6 Gm.); children, gr. 3–5 (.2–.3 Gm.), mouth or subcutaneously.

Properties and Uses.—Specific for syphilis in all stages; where system repels mercury and iodides. Incipient tabes, early paralysis, epilepsy due to syphilis; spinilum affections—malaria, relapsing fever, frambesia, substitute for arsenic in diseases of skin, nerves, blood; should not be employed in presence of eye troubles.

Neosalvarsan is the more soluble sodium salt, being tolerated better and given in larger quantities. Dose, gr. 9–14 (.6–.9 Gm.).—Inject each gr. 2.5 (.16 Gm.) in ♏xlv (3 Ml. (Cc.)) distilled water—isotonic solution.

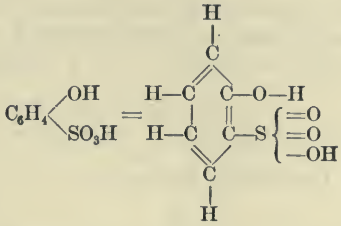
Bromol. Tri-bromo-phenol.—Tri-brom-phenol.



Manufacture: Act on phenol with bromine; thus $C_6H_5OH + 6\,Br = C_6H_2Br_3OH + 3HBr$. It is a colorless crystalline powder, soluble in alcohol, chloroform, ether, fixed or volatile oils, insoluble in water; melts at 95° C. (203° F.); odor unpleasant, taste sweetish, astringent. Dose, gr. 1–8 (.06–.5 Gm.); locally 3 p. c. solution in oil, also 12.5 p. c. ointment, or 3–10 p. c., + talcum—dusting-powder. Should not be confounded with *bromal*.

Properties and Uses.—Antiseptic, disinfectant, caustic; tuberculous ulcers, gangrene, diphtheria, cholera infantum.

Aseptol. Ortho-phenol Sulphonic Acid.—Sozolic Acid, Sulpho-(carbol) phenol.

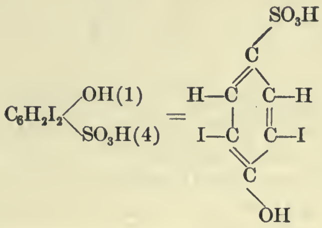


$C_6H_4{<}{OH \atop SO_3H}$

Manufacture: Mix phenol and sulphuric acid at a very low temperature, allow to stand several days, purify this product by converting it into the barium salt and precipitating barium with H_2SO_4. It is a solution containing 33 p. c. ortho-phenol-sulphonic acid, having a sour taste, acid reaction, and phenol-like odor.

Properties and Uses.—Antiseptic. Like phenol, but possesses only one-third of its antiseptic power.

Sozoiodol. Sozoiodolic Acid.—Di--iodo-para-phenyl-sulphonic acid.

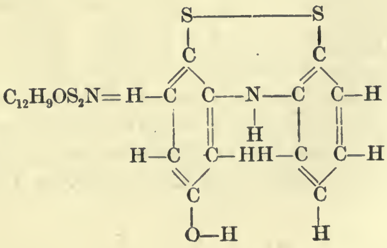


$C_6H_2I_2{<}{OH(1) \atop SO_3H(4)}$

Manufacture: Phenol (2) and sulphuric acid (1) are heated together for 3 days at 110° C. (230° F.), forming para-phenol-sulphonic acid, and this is treated with iodine. The compound crystallizes from water in needle-shaped prisms which are soluble in alcohol or water; contains iodine 54 p. c., phenol 20 p. c., sulphur 7 p. c.

Properties and Uses.—Antiseptic in 2–3 p. c. solutions. The metallic salts which this acid forms are good substitutes for iodoform, those with sodium being preferred.

Sulphaminol. Thio-oxy-diphenylamine.



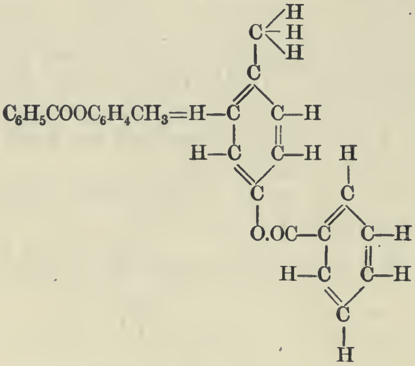
$C_{12}H_9OS_2N$

Manufacture: Boil together meta-oxy-diphenylamine, sodium hydroxide solution, and sulphur, treat filtered solution with ammonium chloride. It occurs as a yellow, odorless, tasteless powder, soluble in alkalies, insoluble in water; melts at 155° C. (311° F.).

Properties and Uses.—Antiseptic. As a substitute for iodoform.

Cresol. Cresylic Acid, $C_6H_4(CH_3)OH$.—(*Official*). See page 854.

Benzo-para-cresol. Para-cresyl-benzoate.



Manufacture: Benzoyl chloride is allowed to act on the sodium salt of para-cresol. It is in colorless needles, soluble in chloroform, ether, hot water, insoluble in water; melts at 71° C. (160° F.).

Properties and Uses.—Antiseptic. The preparations creolin, lysol, saprol, solutol, solveol, sozal, etc., are complex mixtures of the three cresols—ortho, meta, para.

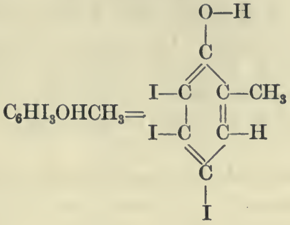
Creolin. Creolinum.—Creolins are antiseptic and disinfectant soluble preparations of cresols (free from phenol) made soluble by means of rosin soap or sulphonation with sulphuric acid. Those with soap are usually reddish-black syrupy liquids, tarry odor, sp. gr. 1.040–1.070, forming clear solutions with alcohol, ether, chloroform, benzin, benzene; the sulphonated creolins hold free cresols in solution, forming milky emulsions with water; sodium salicylate is also a good solvent of cresols. Dose, ♏j–5 (.06–.3 Ml. (Cc.)).

Properties and Uses.—Antiseptic, sedative; it is powerful but non-irritating. Used as a substitute for phenol, anti-fermentative. Internally, for gastric fermentation, dysentery, and typhoid fever.

Lysol. Lysolum.—Made by reserving distillate from the coal-tar oil that comes over between 190–200° C. (374–392° F.), which is boiled in fat until dissolved, then saponified with alcohol (or alkali). It is a brown, oily-looking, clear liquid, aromatic odor resembling creosote; contains 50 p. c. of cresol; it is soluble in water, forming clear, frothing, saponaceous liquid, also in alcohol, chloroform, or glycerin.

Properties and Uses.—Antiseptic in surgery, gynecology. It is 5 times stronger, but only one-eighth as poisonous as phenol, and one-half as poisonous as creolin. Useful in skin diseases, lupus, diphtheria, gargle for foul breath. Should be applied in aqueous solution (1–3 p. c.).

Losophane. Tri-iodo-meta-cresol.—



Manufacture: Add aqueous solution of iodine and potassium iodide slowly, with stirring, to solution of ortho-oxyparatoluic acid in sodium bicarbonate and water, after 24 hours wash precipitate with water, crystallize from alcohol. It is in colorless, odorless needles, slightly acid, soluble in benzene, chloroform, ether, diluted NaOH, slightly in alcohol, insoluble in water, decomposed by strong caustic soda; melts at 122° C. (251° F.); contains iodine 78.39 p. c.

Properties and Uses.—Antiseptic. In parasitic skin affections, eczema, prurigo. Apply in 1–2 p. c. solutions of alcohol 3 vols. + water 1, or in 1–10 p. c. ointments of vaseline or wool-fat.

Thymolis Iodidum. Thymol Iodide. Aristol, $C_{20}H_{24}O_2I_2$.—(*Official.*) See page 856.

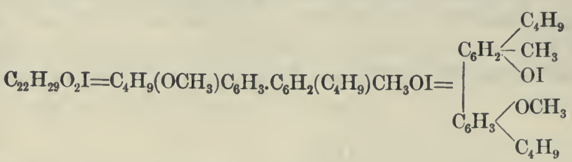
Ichthyolum. Ichthyol, $C_{28}H_{36}S_3O_6(NH_4)_2$.—Ammonium-sulpho-ichthyolate, Ammonium-ichthyol-sulphonate.

Manufacture: This is a crude oil obtained by the destructive distillation of a European bituminous rock containing petrified fossil remains of fish and other animals. This oil when saturated with H_2SO_4 becomes heated to 100° C. (212° F.), forming ichthyol-sulphonic acid with evolution of SO_2; treat now with NaOH (or NaCl) solution to remove H_2SO_3 and H_2SO_4, saturate residue with ammonia. It is a viscous, reddish-brown, syrupy liquid, bituminous odor and taste, soluble in water, glycerin, fats. Dose, gr. 10–20 (.6–1.3 Gm.), ter die.

Sodium-sulpho-ichthyolate is the most important salt for administering in pill-form, although we have the corresponding salts of lithium, zinc, and mercury. All of these are obtained by saturating the acid with the respective oxides or carbonates.

Properties and Uses.—Alterative, anodyne, discutient; chronic rheumatism, gout, lepra, eczema, urticaria, acne, intertrigo, lupus, ulcers, lymphatic enlargements, burns, frostbites, sprains, contusions, psoriasis, prostatitis. Give in pill, or apply ointment (20–50 p. c.) with wool fat.

Europhen. **Di-iso-butyl-ortho-cresol-iodide.**

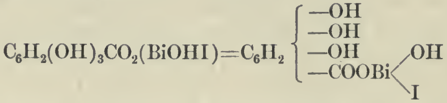


$$C_{22}H_{29}O_2I=C_4H_9(OCH_3)C_6H_3.C_6H_2(C_4H_9)CH_3OI=\begin{array}{l} C_6H_2\left<\begin{array}{l}C_4H_9\\ CH_3\\ OI\end{array}\right. \\ \quad | \\ C_6H_3\left<\begin{array}{l}OCH_3\\ C_4H_9\end{array}\right.\end{array}$$

Manufacture: Europhen is made like aristol, but iso-butyl-ortho-cresol is used instead of thymol. It is an amorphous golden-yellow powder, saffron-like odor, 5 times as bulky as iodoform, soluble in alcohol, ether, chloroform, olive oil (4), insoluble in water or glycerin; melts at 110° C. (230° F.), forming a clear brown liquid; contains iodine 28 p. c. Dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.).

PROPERTIES AND USES.—Antiseptic, germicide, bactericide. Possesses about the same power, and used like iodoform for wounds, ulcers, burns, psoriasis, eczema, lupus, chancres, rhinitis, in ointment.

Bismuth Oxyiodogallate. **Airol.**—



$$C_6H_2(OH)_3CO_2(BiOHI)=C_6H_2\left\{\begin{array}{l}-OH\\ -OH\\ -OH\\ -COOBi\left<\begin{array}{l}OH\\ I\end{array}\right.\end{array}\right.$$

Manufacture: By combining basic bismuth, oxygen, and iodine. It is a grayish-green, odorless, tasteless powder, turning red by moisture, thereby losing iodine; contains Bi_2O_3 44.5 p. c., iodine 24.8 p. c.

PROPERTIES AND USES.—Antiseptic; good substitute for iodoform; abscesses, burns, chancres, metritis, rhinitis, vaginitis, ulcers; in powder, ointment (10–20 p. c.) with lard, vaseline, glycerin.

Bismuth Tribromophenol, Xeroform, $(C_6H_2Br_3O)_2BiOH+Bi_2O_3$. *Manufacture:* By combining chemically equal quantities of bismuth and tribromphenol. It is a yellowish-green, odorless, tasteless, insoluble powder; contains Bi_2O_3 50 p. c. Intestinal antiseptic; acute and chronic enteritis, burns, infected wounds, ulcers; in place of iodoform.

Antiseptin. **Boro-thymol Zinc Iodide.**
Manufacture: This is a mixture of zinc sulphate (85), zinc iodide (2.5), thymol (2.5), boric acid (10). Antiseptic for wounds, ulcers, etc.

8. DI-HYDROXY PHENOL DERIVATIVES.

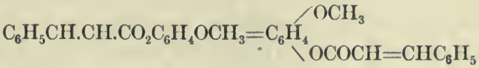
Guaiacol. **Guaiacol.** **Guaiacolum,** $C_7H_8O_2$.—(*Official.*) See page 855.

PREPARATIONS.—1. *Guaiacolis Carbonas,* $(C_6H_4OCH_3)_2CO_2$.—(*Official.*) See page 856.

2. *Guaiacolis Benzoas.* Guaiacol Benzoate, Benzosol, Benzoyl Guaiacol, $C_6H_4OHC_6H_5CO_2$.

Manufacture: Act on the potassium salt of guaiacol with benzoyl chloride. It is a colorless crystalline powder, odorless, tasteless, soluble in alcohol, chloroform, ether, insoluble in water; melts at 56° C. (133° F.); alcoholic solution of potassium hydroxide saponifies it, sulphuric acid turns it lemon-yellow, but ferric chloride produces no color in alcoholic solutions. Dose, gr. 5–30 (.3–2 Gm.).

3. *Guaiacolis Cinnamas.* Guaiacol Cinnamate, Styracol, Cinnamyl Guaiacol.

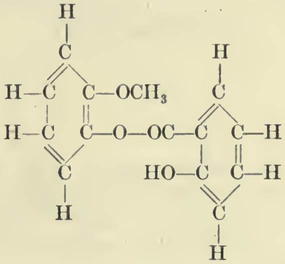


$$C_6H_5CH.CH.CO_2C_6H_4OCH_3{=}C_6H_4\begin{matrix}\diagup OCH_3 & (1)\\ \diagdown OCOCH{=}CHC_6H_5 & (2)\end{matrix}$$

Manufacture: Act on guaiacol with cinnamyl-chloride by heating on water-bath, crystallize from boiling alcohol. It is in white needle crystals, soluble in ether, chloroform, insoluble in water. Dose, gr. 2–10 (.13–.6 Gm.).

4. *Guaiacolis Salicylas.* Guaiacol Salicylate, Guaiacol Salol.

$C_6H_4OHCO_2,C_6H_4OCH_3=$



Manufacture: Act on a mixture of sodium-guaiacol and sodium salicylate with phosphorus oxychloride. It is a white crystalline powder, analogous to salol, soluble in alcohol, chloroform, ether, insoluble in water. Dose, gr. 5–30 (.3–2 Gm.).

Properties and Uses.—For the same purposes as creosote, but is less valuable, it is also less irritating to the intestinal canal and kidneys; phthisis, external tubercle, lupus, cough, expectoration, antiseptic. The benzoate splits in the system into guaiacol and benzoic acid, and so possibly do the others separate into their original components; the cinnnamate is useful in gleet, vesical catarrh, diarrhœa.

Eugenol. Eugenol. Eugenic Acid, $C_{10}H_{12}O_2$—(*Official.*) See page 418.

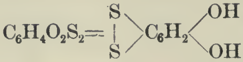
Eugenol Acetamide, $C_{10}H_{11}O_2,COCH_2NH_2$.

Manufacture: Act on chloracetic acid with the sodium salt of eugenol, producing eugenol acetic acid; this being changed to the ethyl-ester is treated with alcoholic ammonia, giving thus the amide. It crystallizes in fine needles, melts at 110° C. (230° F.).

Properties and Uses.—Anæsthetic, antiseptic, similar to cocaine; dentistry, etc.

Resorcinol. Resorcinol.—Resorcinum, Resorcin, Meta-di-hydroxybenzene. (*Official.*) See page 857.

Thioresorcin.

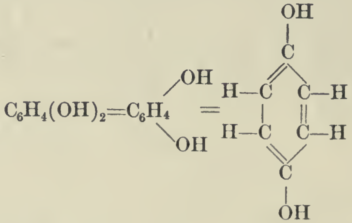


$$C_6H_4O_2S_2 = \left.\begin{matrix}S\\ |\\ S\end{matrix}\right\rangle C_6H_2 \left\langle\begin{matrix}OH\\ OH\end{matrix}\right.$$

Manufacture: Heat resorcin (1), sodium hydroxide (3), and sulphur (3) with water until solution effected, acidify the solution to get flocculent precipitate, dry. It is a yellowish amorphous powder, soluble in alkalies, carbonates, and sulphides, insoluble in ordinary reagents.

PROPERTIES AND USES.—Antiseptic, similar but inferior to iodoform.

Hydroquinone. Hydrochinone. Quinol.—Hydroquinol, Para-di-hydroxy-benzene.



Manufacture: Oxidize aniline with potassium dichromate and sulphuric acid, then reduce the resulting quinone ($C_6H_4O_2$) with acid sodium sulphite (sulphurous acid). It crystallizes from water in hexagonal prisms, which heated sublime undecomposed; soluble in alcohol, ether, hot water, slightly in cold water, melts at 169° C. (336° F.), it reduces $AgNO_3$ solution on warming, and Fehling's solution at ordinary temperature. Dose, gr. 10–20 (.6–1.3 Gm.).

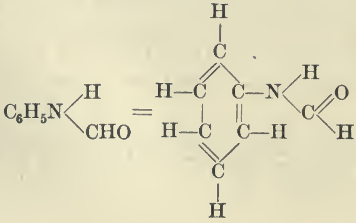
PROPERTIES AND USES.—Antipyretic, antiseptic; fevers of phthisis and pneumonia.

Pyrogallol. Pyrogallic Acid.—Tri-hydroxy-benzene, $C_6H_6O_3$. (*Official.*) See page 153.

9. BENZENE DERIVATIVES CONTAINING NITROGEN. AMIDO DERIVATIVES.

The best known amine of this series is aniline, $C_6H_5NH_2$. In aniline the ammonia residue, NH_2, replaces 1 of the hydrogen atoms in benzene (C_6H_6); these hydrogen atoms in NH_2 may be replaced by hydrocarbon or acid residues.

Formanilide. Formanilidum.—Phenylformamide.

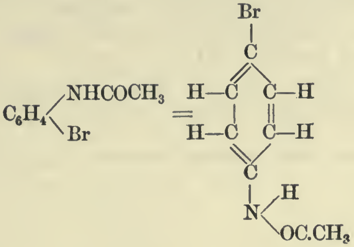


Manufacture: Distil a mixture of aniline and oxalic acid (formic acid)—$C_6H_5HN_2 + H_2C_2O_4 = C_6H_5NHCOH + CO_2 + H_2O$. It is in colorless prismatic needles or crystals, soluble in alcohol, partially in water, melts at 46° C. (115° F.), diluted acids decompose it into aniline and formic acid. Dose, gr. 2–5 (.13–.3 Gm.).

Properties and Uses.—Antipyretic, antineuralgic, analgesic.

Acetanilidum. Acetanilid.—Antifebrin, C_8H_9NO. (*Official.*) See page 864.

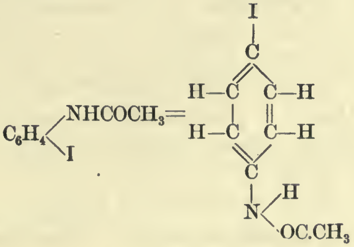
Antisepsin. Asepsin.—Acetbromanilid, Para brom-acetanilid.



Manufacture: To a solution of acetanilid in acetic acid add bromine. The product is purified by crystallization from alcohol. It is in colorless, monoclinic prisms, soluble in alcohol, insoluble in water, melts at 166° C. (331° F.). The ortho-compound is more soluble in alcohol, melts at 99° C. (210° F.). Dose, gr. 3–8 (.2–.5 Gm.), ter die.

Properties and Uses.—Antiseptic, antipyretic, analgesic; typhoid fever, pneumonia, phthisis; locally to wounds, bites.

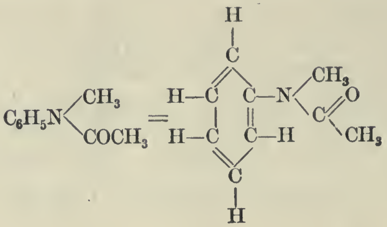
Iodoacetanilid. Iodoantifebrin.—Para-iodo-acetanilid.



Manufacture: Heat together acetic acid and para-iodo-aniline. It is in colorless, rhombic tablets, odorless, tasteless, soluble in alcohol, acetic acid, hot water, slightly in cold water, melts at 181° C. (358° F.). Dose, gr. 1–5 (.06–.3 Gm.).

Properties and Uses.—Antipyretic, analgesic, anodyne.

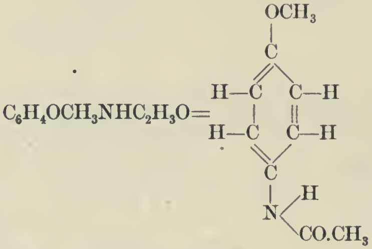
Methylacetanilid. Methylacetanilidum.—Exalgine, Methyl-phenyl-acetamide, Acetmethyl-anilid.



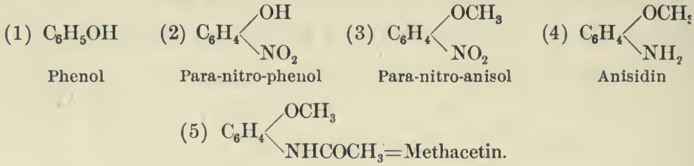
Manufacture: Act on mono-methyl-aniline $\left(C_6H_5N\begin{matrix}CH_3\\H\end{matrix}\right)$ with acetylchloride. Methylacetanilid is in needles, or in long, tablet-like crystals, soluble in alcohol, slightly so in water, melts at 102° C. (215° F.). Dose, gr. 1–5 (.06–.3 Gm.).

Properties and Uses.—Antineuralgic, analgesic, antiseptic; neuralgia, chorea, rheumatism, sciatica, superior to antipyrine.

Methacetin. Para-acetanisidin.—Para-oxy-methyl-acetanilid.



Manufacture: by the following steps:



(1) C_6H_5OH Phenol

(2) $C_6H_4\begin{matrix}OH\\NO_2\end{matrix}$ Para-nitro-phenol

(3) $C_6H_4\begin{matrix}OCH_3\\NO_2\end{matrix}$ Para-nitro-anisol

(4) $C_6H_4\begin{matrix}OCH_3\\NH_2\end{matrix}$ Anisidin

(5) $C_6H_4\begin{matrix}OCH_3\\NHCOCH_3\end{matrix}$=Methacetin.

This approximates closely to phenacetin; occurs in colorless, odorless scales, soluble in alcohol, acetone, glycerin, fatty oils, slightly in water, benzene, and ether. Dose, gr. 2–8 (.13–.5 Gm.).

Properties and Uses.—Antipyretic; typhoid, rheumatism.

Acetphenetidin. Acetphenetidinum. Phenacetin, $C_6H_4.OC_2H_5.$-NHC_2H_3O.—(*Official.*) See page 865.

Thermodin. Phenacetin-urethane. Acetylparethoxyphenylurethane, $C_{13}H_{17}NO_4$.

Manufacture: This compound of phenacetin and urethane is obtained by the action of ethyl chloro-carbonate on paraphenetidin, thereby forming paraethoxyphenyl-urethane, which is converted into the ethyl form by heating with acetic anhydride. Occurs in colorless, odorless, tasteless crystals, melting at 86° C. (187° F.), insoluble in water.

Properties and Uses.—Analgesic, antipyretic, antiseptic; typhoid, pneumonia, influenza, tuberculosis, febrile conditions in general. Dose, analgesic, gr. 15–20 (1–1.3 Gm.); antipyretic, gr. 5–10 (.3–.6 Gm.).

Chinaphenine. Quinine Carbo-phenetidide. Phenetidin Quinine Carbonic Acid Ester, $C_{29}H_{33}N_3O_4$.

Manufacture: By action of quinine on p-ethoxyphenyl carbamic acid chloride. Occurs as a white, odorless, tasteless powder, soluble in alcohol, ether, chloroform, benzene, sparingly in water, forms soluble salts with acids and by latter decomposed with liberation of quinine.

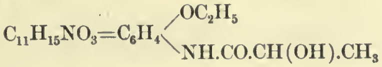
Properties and Uses.—Antiperiodic, antipyretic, anodyne—resembling quinine and phenacetin combined with the advantages of tastelessness and freedom of cinchonism. Malaria, neuralgia, la grippe, whooping-cough, etc. Dose, gr. 2–5–15 (.13–.3–1 Gm.).

Holocaine. Holocainum.—Para-diethoxyethenyl-diphenylamidine, $OC_2H_5.C_6H_4NHC.CH_3.N.C_6H_4.O.C_2H_5 + H_2O$.

Manufacture: May be obtained by combining in molecular quantities phenacetin and para-phenetidin, when water separates, leaving the base—$OC_2H_5.C_6H_4NHC.O.CH_3 + H_2N.C_6H_4.O.C_2H_5 = OC_2H_5.C_6H_4NHC.CH_3.N.C_6H_4.O.C_2H_5 + H_2O$. It occurs in beautiful white needles, which melt at 120° C. (248° F.), soluble in water (40), undecomposed by boiling, which should be accomplished in a porcelain vessel as the solutions attack glass. The hydrochloride, in white crystals, is the salt mostly used, in 1 p. c. solution; it is slightly bitter, neutral, and may be kept for months without change.

Properties and Uses.—Local anæsthetic, germicide, antiseptic, as a substitute for cocaine in ocular surgery. The anæsthesia is produced within a minute and lasts for a quarter of an hour, the burning being about as intense as that following cocaine. Unlike cocaine, it does not change the pupil, the accommodation, or intraocular pressure, does not contract bloodvessels, and additionally acts as an antiseptic. The disadvantages are that it requires to be renewed in 10 to 15 minutes, and is 5 times more toxic than cocaine, hence cannot be used hypodermically; 1 p. c. solution causes a degree of anæsthesia equal to a 3–4 p. c. solution of cocaine.

Lactophenin. Lactopheninum.—Lactyl-phenetidine.

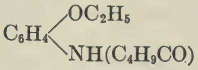


$$C_{11}H_{15}NO_3=C_6H_4\begin{array}{l}\diagup OC_2H_5\\ \diagdown NH.CO.CH(OH).CH_3\end{array}$$

Manufacture: Allow lactic acid to act on phenetidine in the presence of dehydrating substances. It is more soluble than phenacetin, and differs from it only in using lactic instead of acetic acid; occurs as a bitter, odorless, crystalline powder, soluble in alcohol (9), water (320), melts at 118° C. (244° F.). Dose, gr. 8–15 (.5–1 Gm.).

Properties and Uses.—Antipyretic, sedative, analgesic, hypnotic (between sulphonal and urethane); better tolerated than antipyrine, occasioning neither collapse nor cyanosis; rheumatism, pneumonia, typhoid and scarlet fevers, influenza, septicæmia.

Sedatin. **Para-valeryl-amido-(phenetol) phenetidin.**

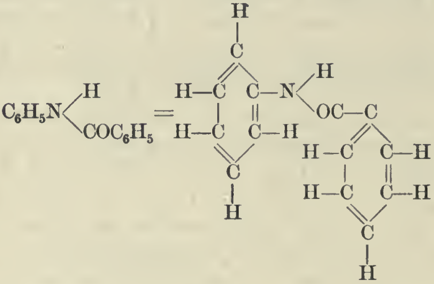


$$C_6H_4{<}\begin{matrix}OC_2H_5\\NH(C_4H_9CO)\end{matrix}$$

Manufacture: Act on para-amido-phenetol with valeric acid or valeryl chloride. It crystallizes in needles, slightly soluble in acetone, chloroform, ether, insoluble in water. Dose, gr. 1–5 (.06–.3 Gm.).

Properties and Uses.—Resembles antipyrine; sedative, antineuralgic.

Benzanilid. **Benzoyl-anilid.**—Phenylbenzamide.



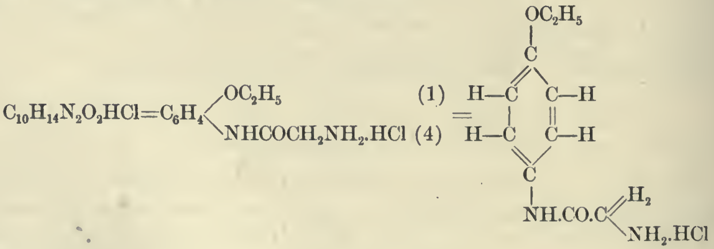
$$C_6H_5N{<}\begin{matrix}H\\COC_6H_5\end{matrix}$$

Manufacture: Act on aniline with benzoyl chloride in the presence of caustic soda. It is in colorless scales, soluble in cold (58), hot alcohol (7), insoluble in water; melts at 162° C. (324° F.).

Benzanilid bears the same relation to benzoic acid that acetanilid does to acetic acid. Dose, gr. 2–8 (.13–.5 Gm.); children gr. 1–5 (.06–.3 Gm.).

Properties and Uses.—Antipyretic, especially in fevers of children.

Phenocoll Hydrochloride. **Phenocollum Hydrochloridum.**—Glycocoll-para-phenetidin hydrochloride.



$$C_{10}H_{14}N_2O_2HCl = C_6H_4{<}\begin{matrix}OC_2H_5 & (1)\\NHCOCH_2NH_2.HCl & (4)\end{matrix}$$

Manufacture: Chlor-acetyl chloride acts on para-amido-phenetol, and the resulting product is treated with ammonia. This is a result of many attempts to form a soluble phenacetin; it is a white crystalline powder, soluble in water (20). When boiled with acids or alkalies it is broken up into phenacetin and glycocoll, and this latter base is precipitated always upon adding ammonia, alkalies, or alkaline carbonates to any of its solutions. Dose, gr. 5–15 (.3–1 Gm.), in capsules.

Properties and Uses.—Antipyretic, antineuralgic, antirheumatic, diaphoretic; hectic fever, chronic and acute rheumatism, neuralgia, hypnotic.

Gallanilide. Gallanol.—Gallinol.

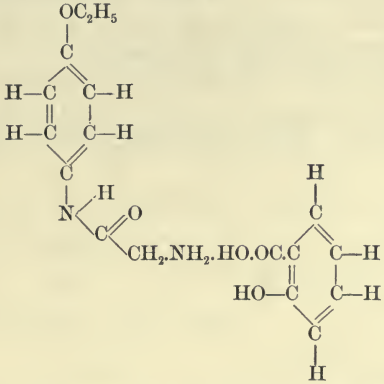
$C_6H_5NH,CO,C_6H_2(OH)_3$

Manufacture: By heating aniline to 150° C. (302° F.) for an hour with tannic or gallic acid ($C_6H_2(OH)_3COOH$); the resulting product is purified by crystallization from diluted alcohol. In colorless, bitter crystals, when free from water melts at 205° C. (401° F.), soluble in hot water, alcohol, ether, or alkalies, slightly in cold water.

Properties and Uses.—Chiefly externally for skin diseases, instead of chrysarobin.

Phenocoll Salicylate. Phenocollum Salicylicum.—Salocoll.

$C_6H_4(OC_2H_5)NHCOCH_2(NH_2)C_7H_6O_3=$

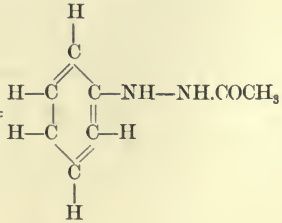


This is soluble in hot water, from which it crystallizes in fine needles; its aqueous solution is neutral in reaction and has a sweet taste. Dose, gr. 5–15 (.3–1 Gm.).

Properties and Uses.—Antipyretic, antirheumatic; combines those of phenocoll and salicylic acid.

Hydracetin. Pyrodin.—Acetyl-phenyl-hydrazine.

$C_6H_5NH—NHCOCH_3=$

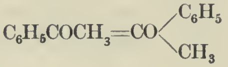


Manufacture: Heat together acetic anhydride, or acetic acid and phenyl-hydrazine, dissolve in boiling water, crystallize. It is in colorless, shining, odorless, tasteless crystals, soluble in alcohol, hot water; melts at 128° C. (263° F.); when boiled with HCl splits into acetic acid and phenyl-hydrazine hydrochloride. Dose, gr. $\frac{1}{6}$–1 (.01–.06 Gm.), ter die.

PROPERTIES AND USES.—Antipyretic, antineuralgic; hectic fever of phthisis, night-sweats. Externally—allied in effect to pyrogallol and chrysarobin in skin diseases (psoriasis, etc.). Apply in ointment 5–10 p. c.; when stronger may poison the system by absorption.

VI. Aldehydes and Ketones.

Hypnone. Acetophenone.—Phenyl-methyl-ketone.

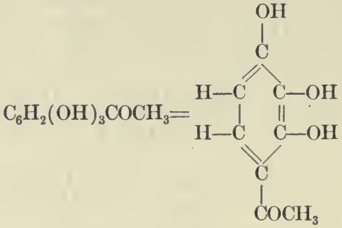


$$C_6H_5COCH_3=CO\begin{cases}C_6H_5\\CH_3\end{cases}$$

Manufacture: 1. Distil a mixture of calcium acetate and benzoate. 2. Act on benzene in the presence of $AlCl_3$ with acetyl chloride. It is in white crystals, melting at 20° C. (69° F.); when in liquid form it is slightly yellow, bitter almond odor, bitter taste, hence objectionable to some persons. Dose, gr. or ♏v–15 (.3–1 Ml. (Cc.) or Gm.), which must be increased largely upon usage.

PROPERTIES AND USES.—Hypnotic, but somewhat uncertain.

Gallacetophenone. Tri-oxy-acetophenone.—Alizarin Yellow.

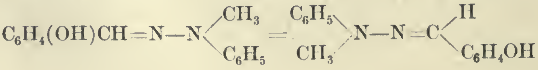


$C_6H_2(OH)_3COCH_3=$

Manufacture: Heat to 145–150° C. (293–302° F.) for a short time a mixture of pyrogallol 1, zinc chloride and glacial acetic acid, each $1\frac{1}{2}$; to this hot fused mass add water, when gallacetophenone separates out, which may be purified by crystallizing from hot water. It occurs in dirty, flesh-color, powdery crystals, soluble in alcohol, ether, glycerin, hot water, or cold water (600).

PROPERTIES AND USES.—Antiseptic; skin affections (psoriasis, etc.), in 10 p. c. solutions or ointments, being a good substitute for pyrogallol, as it does not stain nor poison so easily.

Agathin. Salicyl Aldehyde-methyl-phenyl-hydrazine.



$$C_6H_4(OH)CH=N-N\begin{cases}CH_3\\C_6H_5\end{cases}=\begin{matrix}C_6H_5\\CH_3\end{matrix}\Big\rangle N-N=C\begin{cases}H\\C_6H_4OH\end{cases}$$

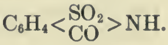
Manufacture: By the direct union of methyl-phenyl-hydrazine and salicylic aldehyde. It is in small greenish crystals, soluble in alcohol, benzene, ether, insoluble in water. Dose, gr. 5–10 (.3–.6 Gm.).

PROPERTIES AND USES.—Antineuralgic; neuralgia, rheumatism.

8. CARBOXYL DERIVATIVES (CO_2H).

Benzoic Acid. Acidum Benzoicum, $C_7H_6O_2$.—(*Official.*) See page 458.

Benzosulphinide. Benzosulphinidum, Saccharin,

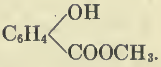


$C_6H_4<{}^{SO_2}_{CO}>NH$. —(*Official.*) See page 866.

9. OXYBENZOIC (SALICYLIC) DERIVATIVES.

Salicylic Acid. Acidum Salicylicum, $C_7H_6O_3$.—(*Official.*) See page 858.

Methyl Salicylas. Artificial Oil of Wintergreen,



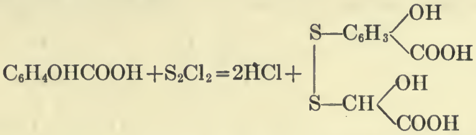
$C_6H_4\begin{matrix}\diagup OH\\ \diagdown COOCH_3\end{matrix}$ —(*Official.*) See page 450.

Di-iodo-salicylic Acid, $C_6H_2I_2(OH)COOH$.

Manufacture: To an alcoholic solution of salicylic acid add iodine and iodic acid. Occurs as a crystalline powder, sweetish taste, melts at 220–230° C. (428–446° F.) with decomposition, soluble in alcohol, ether, boiling water (660), cold water (1500). Dose, gr. 5–20 (.3–1.3 Gm.).

PROPERTIES AND USES.—Analgesic, antiseptic, antipyretic.

Sodium di-thio-salicylate.



$$C_6H_4OHCOOH+S_2Cl_2=2HCl+\begin{array}{l}S{-}C_6H_3\begin{matrix}\diagup OH\\ \diagdown COOH\end{matrix}\\ |\\ S{-}CH\begin{matrix}\diagup OH\\ \diagdown COOH\end{matrix}\end{array}$$

Manufacture: Heat together salicylic acid and sulphur chloride. It is a gray, hygroscopic, amorphous powder, soluble in water. Dose, gr. 5–15 (.3–1 Gm.).

PROPERTIES AND USES.—Antiseptic, antipyretic, analgesic.

Phenyl Salicylate. Phenylis Salicylas. Salol, $C_6H_5C_7H_5O_3$.—(*Official.*) See page 859.

Aspirin. Acetyl-salicylic Acid, $C_6H_4COOHCO_2CH_2$.

Manufacture: By prolonged heating salicylic acid (50) and acetic anhydride or acetyl chloride (75) at 150° C. (302° F.), recrystallizing from chloroform. Occurs in small, colorless, crystalline needles, acidulous taste, melting at 135° C. (275° F.), soluble in alcohol, ether, chloroform, water (100), in which upon boiling or with alkalies it splits into components—acetic acid and salicylic acid (salicylate);

distinguished from salicylic acid by adding ferric chloride to aqueous or alcoholic solution—no violet color. Should not be confounded with salicylo-acetic acid in glassy scales and used as an antiseptic.

Incompatibles: Alkalies, alkali carbonates and bicarbonates, heat, moisture, etc.

Properties and Uses.—Similar to but better than salicylic acid, as it is almost free from the undesired local and systemic by-effects (tinnitus, etc.), owing to the slow liberation of the salicylic acid; decomposed in the intestine but not in the stomach. Rheumatism, internal antiseptic. Dose, gr. 5–15 (.3–1 Gm.), capsules, wafers, dry on tongue, or dissolved in sweetened water, ter die.

Novaspirin **Disalicylic Ester of Anhydromethylene Citric Acid,** $C_{21}H_{16}O_{11}$.

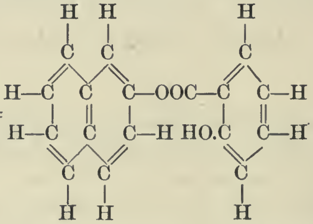
This white, odorless, crystalline powder, obtained by the action of methylene citric acid dichloride on salicylic acid, is soluble in alcohol, slightly in water, chloroform, ether, benzene, decomposed in the intestine, not in the stomach, therefore causing no irritation to latter organ; heated in test-tube melts, liberating formaldehyde.

Properties and Uses.—Similar to aspirin, but possibly a better preparation from being unattended by secondary effects; rheumatic, gouty, and neuralgic conditions, coryza, influenza, tonsillitis. Dose, gr. 5–15 (.3–1 Gm.), ter die.

Meta-cresalol, $C_6H_4(OH)CO_2C_6H_4CH_3$, and **Para-cresalol,** $C_6H_4(OH)CO_2C_6H_4CH_3$, are made by condensation of salicylic acid with either meta- or para-cresol. Both occur in colorless, odorless, tasteless crystals, and are used like salol. Dose of either, gr. 5–30 (.3–2 Gm.).

Betol. **Naphtho-salol.**—Naphthyl Salicylate, Salinaphthol.

$C_6H_4(OH)COOC_{10}H_7=$

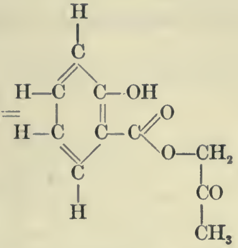


Manufacture: By replacing a hydrogen atom in salicylic acid by naphthol group ($C_{10}H_7$), instead of phenol group (C_6H_5) as in salol. Heat together beta-naphthol sodium, sodium salicylate, and phosphorus oxychloride. It is a white, tasteless, inodorous, crystalline powder, soluble in boiling alcohol, ether, benzene, warm fixed oils, insoluble in water or glycerin. Dose, gr. 2–5 (.13–.3 Gm.).

Properties and Uses.—Intestinal antiseptic; articular rheumatism, vesical catarrh, cystitis; instead of salol.

Salacetol. Acetol Salicylate.

$C_6H_4(OH)COOCH_2COCH_3=$

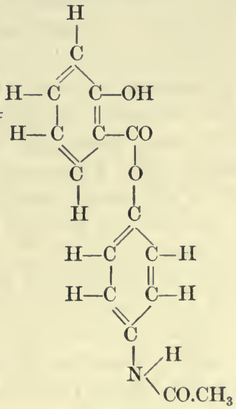


Manufacture: Differs from salol in replacing the phenol group (C_6H_5) by acetone radical ($CH_2—CO—CH_3$). Heat together sodium salicylate and mono-chlor-acetone—$C_6H_4(OH)COO[Na+Cl]CH_2$-$COCH_3=NaCl+C_6H_4(OH)COOCH_2COCH_3$. Occurs in needle crystals, bitter taste, melts at 71° C. (160° F.), soluble in alcohol (15), castor oil (25), olive oil (30), water (2200). Dose, gr. 15–30 (1–2 Gm.).

Properties and Uses.—Similar to salol; rheumatism, diarrhœa.

Salophen. Salophenum.—Acetyl-para-amido-phenolsalicylate, Acetparamidophenol-salicylsäureester, Acetparamidosalol.

$C_6H_4(OH)CO_2C_6H_4NHCOCH_3=$

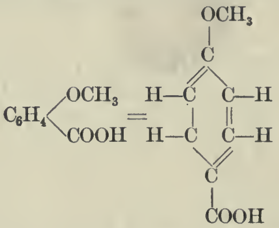


Manufacture: By a complicated process resembling somewhat that for salol—para-nitro-phenol-salicylate ($C_6H_4(OH)COOC_6H_4NO_2$) is formed by condensation of salicylic acid and para-nitro-phenol; this upon reduction gives para-amido-phenol-salicylate ($C_6H_4(OH)COOC_6$-H_4NH_2), and this acted on by acetic acid gives salophen. It is in white scales, odorless, tasteless, soluble in alcohol, ether, alkalies, insoluble in water, melts at 188° C. (370° F.); contains 51 p. c. of salicylic acid. Dose, gr. 5–15 (.3–1 Gm.).

Properties and Uses.—Antiseptic, antipyretic. As a substitute for salol or salicylic acid in acute articular rheumatism, also as an intestinal antiseptic. It is much safer and equally as efficient as salol.

10. Para-oxybenzoic Derivatives.

Anisic Acid. Methyl-para-oxy-benzoic Acid.



$C_6H_4\begin{matrix}OCH_3\\COOH\end{matrix}$

Manufacture: 1. By the oxidation of para-cresyl-methyl ether. 2. By heating methyl iodide with potassium para-oxy-benzoate. 3. By the oxidation of anethol. It is a light, colorless crystalline powder, soluble in alcohol, ether, slightly in water; melts at 184° C. (363° F.), boils at 277° C. (530° F.). Dose, gr. 2–5–10 (.13–.3–.6 Gm.).

Properties and Uses.—Antiseptic, antirheumatic, neuralgia, acts like salicylic acid; usually given as sodium anisate.

Orthoform. Orthoformum.—Methyl-para-amido-meta-oxybenzoate.

$C_6H_3OH(NH_2)C_2H_3O_2$.

This is a permanent, colorless, odorless, tasteless, crystalline powder, slightly soluble in water; the chloride quite soluble, but so acid as often to preclude its use. Dose, gr. 5–10 (.3–.6 Gm.).

Properties and Uses.—Local anæsthetic, analgesic, antiseptic. Has no action on sound mucous membranes or unbroken skin, and serves best as a dusting-powder to painful abrasions, burns, ulcers, or to gastric cancers and ulcers. Anæsthesia is induced as quickly as by cocaine, and is more persistent (many hours to several days), owing to the feeble solubility and tardy elimination of the drug, but it does not penetrate the tissues to the same extent, benumbing only those nerve-ends with which it comes in direct contact. May apply 5 p. c. solution of the chloride in diluted alcohol, and 10–20 p. c. ointments.

Orthoform-new. Methyl Metamidoparoxybenzoate. Meta-amido-para-oxybenzoate of Methyl, $C_6H_3.(COO.CH_3)(NH_2)(OH)$.-1 : 3 : 4.

Manufacture: By the nitration of methyl paroxybenzoate and reduction of the resulting nitro-product. Occurs as a fine, white, neutral, odorless, tasteless, crystalline powder, melting at 141° C. (286° F.), soluble in alcohol (6), ether (50), insoluble in water, but decomposed when boiled in it, yielding methyl alcohol and paroxybenzoic acid, incompatible with alkalies and their carbonates.

Properties and Uses.—Substitution for orthoform, which has proven unsatisfactory. Local anæsthetic, analgesic, resembling cocaine, but owing to insolubility does not penetrate tissues, antiseptic, non-toxic: dentistry, catarrh, hay fever, and internally to relieve pain of gastric ulcer, etc. Dose, gr. 8–15 (.5–1 Gm.), emulsion; apply as a dusting-powder, or with milk-sugar for insufflation, or dissolve in ether, oil, wool fat, etc.

Orthoform-new Hydrochloride is the most important salt, being soluble in water (10).

Anesthesin. — Paramidobenzoic acid ethyl ester, $C_6H_4(NH_2)(COOC_2H_5)$.

Manufacture: Ethylate paramidobenzoic acid by action of sulphuric acid and alcohol, reduce ether obtained by action of zinc and hydrochloric acid. It is a white, crystalline powder, melting at 90° C. (194° F.), odorless, tasteless, but benumbing tongue, soluble in ether, benzene, alcohol (6), practically insoluble in water, but decomposed by long boiling in it or warming with dilute alkalies.

Incompatibles: Alkalies and their carbonates.

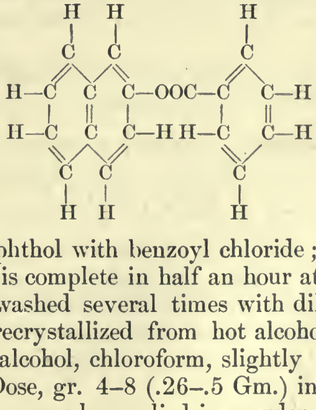
PROPERTIES AND USES.—Substitute for cocaine—local anæsthetic, similar in action to orthoform, but free from irritation and toxicity; owing to insolubility effect is more prolonged than cocaine, and cannot be used hypodermically. Locally—more effective when skin is broken —in rhinologic and laryngeal affections, urethritis, anæsthetizing abraded surfaces, burns, ulcerations, painful skin affections; internally to relieve pain of gastralgia, ulcer, and cancer of stomach. Dose, gr 5–8 (.3–.5 Gm.), pastilles, dusting-powder (pure or diluted), ointment (10 p. c.), suppositories.

11. NAPHTHALENE DERIVATIVES.

Betanaphthol. Betanaphthol. Naphtol, $C_{10}H_7OH$. — (*Official.*) See page 861.

Benzonaphthol. Naphtyl Benzoate.—Beta-naphtholum Benzoicum.

$H_{17}C_{12}O_2{=}C_6H_5COOC_{10}H_7{=}$



Manufacture: Act on beta-naphthol with benzoyl chloride; reaction begins at 125° C. (257° F.) and is complete in half an hour at 170° C. (408° F.), when the product is washed several times with dilute solution of sodium hydroxide and recrystallized from hot alcohol. It is in colorless needles, soluble in alcohol, chloroform, slightly in water, melts at 107° C. (225° F.). Dose, gr. 4–8 (.26–.5 Gm.) in capsule, or suspended in syrup and water; may be applied in powder.

Properties and Uses.—Local and intestinal antiseptic.

Di-iodo-beta-naphthol. Naphthol-aristol, $C_{10}H_5I_2OH$.—This compound is prepared like aristol; greenish-yellow, slightly soluble in alcohol, ether, acetic acid, very soluble in chloroform, insoluble in water.

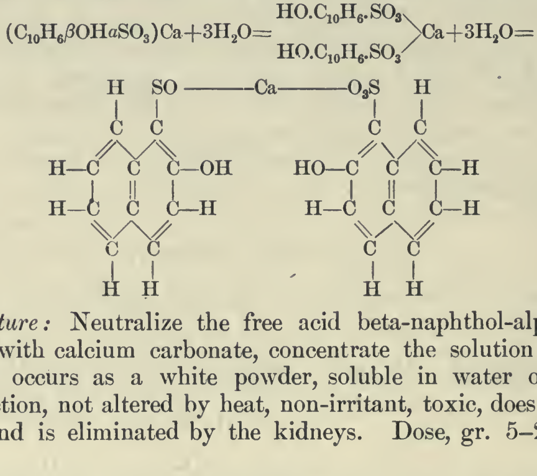
Properties and Uses.—Antiseptic; locally like iodoform.

Naphthol-bismuth. Betanaphthol-bismuth. Orphol, $C_{10}H_7O.Bi_2O_2(OH)$.

Manufacture: Act on bismuth ternitrate dissolved in dilute glycerin or acid with alkaline solution of beta-naphthol. It is a light-brown, odorless powder, slight aromatic taste, insoluble in water, alcohol, and splits up in the duodenum into naphthol and bismuth hydroxide.

Properties and Uses.—Intestinal astringent, antiseptic, substitute for iodoform; cholera infantum, gastro-intestinal catarrh, typhoid fever. Dose, gr. 5–8 (.3–.5 Gm.), 5–6 times daily.

Asaprol. Calcium beta-naphthol-alpha-mono-sulphonate.

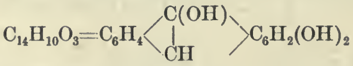


$$(C_{10}H_6\beta OH\alpha SO_3)Ca+3H_2O=\begin{matrix}HO.C_{10}H_6.SO_3\\HO.C_{10}H_6.SO_3\end{matrix}\Big>Ca+3H_2O=$$

Manufacture: Neutralize the free acid beta-naphthol-alpha-mono-sulphonate with calcium carbonate, concentrate the solution and crystallize. It occurs as a white powder, soluble in water or alcohol, neutral reaction, not altered by heat, non-irritant, toxic, does not affect digestion, and is eliminated by the kidneys. Dose, gr. 5–20 (.3–1.3 Gm.).

Properties and Uses.—Antiseptic, antipyretic, analgesic; influenza, typhoid fever, rheumatism.

Anthrarobin. Des-oxy-alizarin.—Dioxy-anthrol, Leuko-alizarin.



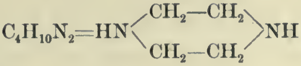
$$C_{14}H_{10}O_3=C_6H_4\Big<\begin{matrix}C(OH)\\|\\CH\end{matrix}\Big>C_6H_2(OH)_2$$

Manufacture: Act on alizarin with nascent hydrogen—$C_{14}H_8O_4+H_4=C_{14}H_{10}O_3+H_2O$. It occurs as a yellowish powder, soluble in caustic alkalies, glycerin, or alcohol, insoluble in water or diluted acids.

Properties and Uses.—In skin diseases like chrysarobinum; ointment (10–20 p. c.). See page 320.

VII. ORGANIC BASES.

Piperazine. Piperazina.—Diethylene-diamine, Ethylene-imine, Arthriticine.

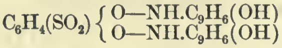


Manufacture: By the action of ammonia upon ethylene bromide or chloride, giving a mixture of salts of different bases, including diethylene diamine, which is separated by treating solution of mixed salts with excess of sodium nitrite at 70° C. (158° F.), yielding dinitrosopiperazine as crystalline mass, treat with acids or reducing agents, getting ammonia and salts of piperazine, distil with alkalies to obtain pure base. It is in colorless, acicular crystals, soluble in water, less so in alcohol, very hygroscopic; dissolves 12 times more uric acid than will lithium carbonate, and its urate compound is soluble in water (50), lithium urate in 368. Dose, gr. 10–15 (.6–1 Gm.).

Properties and Uses.—Diuretic. Increases the urea, but diminishes the uric acid in urine; gout, rheumatism; large doses may produce tremors, clonic spasms, general depression.

Lycetol. Dimethyl-piperazine Tartrate, $C_{10}H_{20}N_2O_6$. Obtained by distilling glycerin with ammonium chloride, reducing the dimethylpyrazine, isolated from the distillation products, with sodium, converting base thus obtained, after purification, into the tartrate. It is a white, odorless powder, melting at 250° C. (482° F.), anhydrous, slightly hygroscopic, soluble in water giving acidulous solutions; incompatible with alkalies which liberate the insoluble free base. Diuretic, uric acid solvent, being well tolerated by and free from disturbing effects on stomach; chronic gout, rheumatism, lithiasis. Dose, gr. 15–30 (1–2 Gm.), well diluted, preferably with carbonated water, plain or sweetened.

Diaptherin. Oxy-quin-aseptol.—Oxychinaseptol.



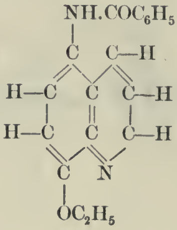
$$C_6H_4(SO_2)\left\{\begin{array}{l}O\text{—}NH.C_9H_6(OH)\\ O\text{—}NH.C_9H_6(OH)\end{array}\right.$$

Manufacture: This is made by uniting 2 molecules of ortho-oxyquinoline with 1 molecule of ortho-phenol-sulphonic acid. It is a bright yellow powder of hexagonal prisms, soluble in water, diluted alcohol, non-caustic and non-toxic, which properties render it preferable to phenol (carbolic acid).

Properties and Uses.—Antiseptic, wounds (in 1 p. c. solutions).

Analgen. Benzanalgen.—Ortho-ethoxy-ana-mono-benzoyl-amidoquinoline.

$C_{18}H_{16}N_2O_2=C_9H_5NOC_2H_5NHCOC_6H_5=$

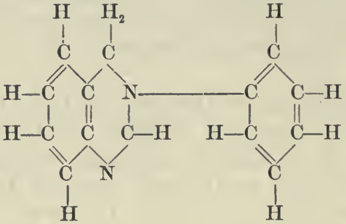


This is obtained, by a very complicated process, as a white, neutral, tasteless powder, soluble in hot alcohol or acids, slightly in cold alcohol, insoluble in water, melts at 208° C. (406° F.). Dose, gr. 10–15 (.6–1 Gm.).

Properties and Uses.—Antipyretic, antirheumatic; rheumatism, neuralgia, headache.

Orexine Hydrochloride. Phenyl-di-hydro-quinazoline Hydrochloride.

$C_6H_4.NCH.CH_2NC_6H_5HCl=C_{14}H_{12}N_2HCl+2H_2O=$



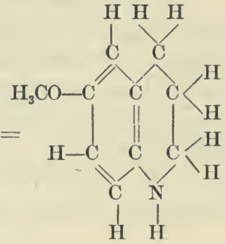
=Orexine base.

Manufacture: Start with formanilide, making sodium formanilide, then orthonitrobenzyl-formanilide, and finally orexine hydrochloride. It occurs as a white powder, or in acicular crystals, bitter, pungent taste, soluble in alcohol, water (13), insoluble in ether, very irritating to the nostrils; tannate causes no gastric irritation.

Properties and Uses.—Stomachic. Dose, gr. 4–8 (.26–.5 Gm.), in wafers, to be accompanied with a large draught of water.

Thalline. Tetra-hydro-para-quin-anisol.

$C_9H_{10}N(OCH_3)=$



Manufacture: Heat a mixture of para-amido-anisol, para-nitro-anisol, glycerin, sulphuric acid, treat this with tin and hydrochloric acid. The free base at ordinary temperatures is an oily liquid, but on cooling gives yellowish-white crystals, soluble in alcohol, ether, benzene, sparingly in benzin or water, anise-like odor, nauseous, with oxidizing agents gives green color and forms salts with acids.

Thalline Sulphate. Thallinæ Sulphas, $2(C_{10}H_{13}NO)H_2SO_4$, or $2C_9H_{10}N(OCH_3)H_2SO_4 + 2H_2O$.—This is obtained by dissolving thalline in diluted sulphuric acid and crystallizing or granulating; it is the salt mostly used, often being designated simply as thalline. It occurs as a yellowish-white crystalline powder, anise-like odor, nauseous, bitter, saline, pungent taste, soluble in hot water, sparingly in chloroform or ether, cold water (7), alcohol (100); solutions darken with age and exposure to light; contains thalline 76.9 p. c. and sulphuric acid 23.1 p. c.

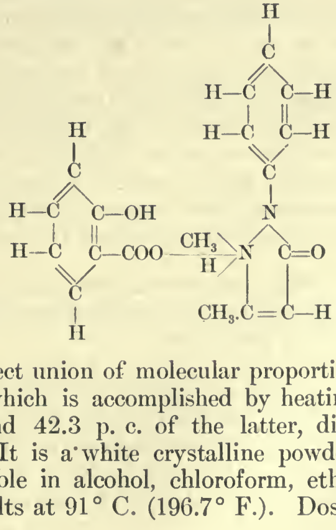
Thalline Tartrate. Thallinæ Tartras, $C_{10}H_{13}NO,C_4H_6O_6$. — This is a yellowish-white crystalline powder, resembling the sulphate in appearance and taste, but is much less soluble in water (10); contains thalline 52.2 p. c. and tartaric acid 47.8 p. c.

Properties and Uses.—These thalline compounds are antipyretics, germicides, rarely used internally, being poisonous; useful as injections for gonorrhœa in 1–2 p. c. solutions.

Antipyrine. Antipyrina, $C_6H_5(CH_3)_2C_3HN_2O$ or $C_{11}H_{12}N_2O$.—(*Official.*) See page 868.

Antipyrine Salicylate. Salipyrine.

$C_{11}H_{12}N_2O.C_7H_6O_3=$



Manufacture: By the direct union of molecular proportions of antipyrine and salicylic acid, which is accomplished by heating together 57.7 p. c. of the former and 42.3 p. c. of the latter, dissolving in alcohol and crystallizing. It is a white crystalline powder, sweetish taste of salicylic acid, soluble in alcohol, chloroform, ether, boiling water (25), water (200), melts at 91° C. (196.7° F.). Dose, gr. 2–20 (.13–1.3 Gm.).

Properties and Uses.—Antirheumatic, antineuralgic; chronic articular rheumatism, sciatica.

Pyramidon.—Dimethyl-amido-antipyrine, $C_{13}H_{17}N_3O$. A substitution product of antipyrine, $C_{11}H_{12}N_2O$, into which a dimethyl-amino group, $N(CH_3)_2$, has been introduced by reducing nitroso-antipyrine to amido-antipyrine and treating this with methyl chloride or iodide. It is a yellowish-white crystalline powder, slightly alkaline, nearly tasteless, melting at 108° C. (226° F.), soluble in alcohol, ether, benzene, water (10), producing with oxidizing agents and acacia colorless solutions, having incompatibilities similar to antipyrine.

Properties and Uses.—Antipyretic, anodyne, similar to antipyrine, but effect upon nervous system more powerful and lasting, can be given in smaller doses, thereby rendering action slower; said to be harmless to blood, kidneys and heart, although the latter's action is stimulated. Chronic fevers of tuberculosis, acute febrile conditions in typhoid, erysipelas, pneumonia. Dose, gr. 5–8 (.3–.5 Gm.), tablets, a single dose usually sufficing for 24 hours.

Hypnal. Monochloral Antipyrine, $CCl_3,CH(OH)_2 + C_{11}H_{12}N_2O$.

Manufacture: About equal quantities of the molecular proportions of antipyrine and hydrated chloral are dissolved each separately in water, then mixed together, and the underlying oily stratum allowed to crystallize. It is in colorless crystals, nearly tasteless, non-irritating to mucous membranes, soluble in water (15), melts at 67.5° C. (154° F.). Dose, gr. 2–20 (.13–1.3 Gm.).

Properties and Uses.—Hypnotic; analgesic.

Iodopyrine. Iodoantipyrine, $C_{11}H_{11}IN_2O$.

Manufacture: A hot solution of iodine (1) in alcohol (12) is mixed with a solution of antipyrine (1) in alcohol (4). The mixture after several days deposits crystals of iodopyrine; this is a substitute for antipyrine in which 1 hydrogen atom in the benzene nucleus is replaced by iodine. It is in colorless, silky, prismatic, tasteless needles, odorless, soluble in hot water, alcohol, slightly in cold water, melts at 160° C. (320° F.). Dose, gr. 2–20 (.13–1.3 Gm.).

Properties and Uses.—Causes fall of temperature, with perspiration, without collapse or shivering. Has no advantage over antipyrine.

Cocaine. Cocaina. Methyl-benzoyl-ecgonine, $C_{17}H_{22}NO_4$, and **Cocaine Hydrochloride. Cocainæ Hydrochloridum,** $C_{17}H_{21}NO_4.HCl$. —(*Official.*) See page 328.

Eucaine. Eucaina.—The eucaines are synthetic alkaloidal derivatives of triacetonamine and vinyl-diaceton-alkalamine, the former yielding commercial alpha-eucaine hydrochloride, the latter, beta-eucaine hydrochloride, both used as substitutes for cocaine, having the advantage of being less toxic, and aqueous solutions not decomposing on boiling.

1. Eucaine Hydrochloride (α) **Eucainæ Hydrochloridum** (α).—Alpha-eucainum (eucaine), Hydrochloride of benzoyl-n-methyltetramethyl-y-oxy-piperidine-carboxylic methylester, $C_{19}H_{27}NO_4.HCl+H_2O$. *Manufacture:* Treat triacetonamine with hydrocyanic acid, hydrolize product by boiling with water, introduce benzoyl and methyl groups by successive treatment with benzoyl chloride and methyl iodide, and the resultant product is the free base—*alpha-eucaine* (*eucaine-α*), which can be crystallized from ether or alcohol. It is in large, glossy colorless prisms, soluble in ether, alcohol, chloroform, benzene, slightly in water, forms salts with acids, the hydrochloride being in glossy neutral scales or plates, soluble in water (10). Differs from cocaine hydrochloride in being less soluble in water, giving yellow crystalline precipitate with 5 p. c. solution chromic acid.

Properties and Uses.—Local anæsthetic like cocaine, for which it was intended as a substitute, but owing to the ocular irritation and frequent toxic effects being similar, it has given way largely to the official salt, beta-eucaine; used on wounds, mucous surfaces, 1–5 p. c. solutions, hypodermically, ♏xv–60 (1–4 Ml. (Cc.)) of 6 p. c. solution; may employ ointment, 1 p. c., + olive oil, 2, wool fat 7. *Poisoning:* Less toxic than cocaine, but when taken internally produces the same effects; excessive quantities should be combated by strong coffee, alcohol, digitalis, strychnine, ammonia, ether, nitroglycerin, etc.

Theobromine. Di-methyl Xanthine, $C_5H_2(CH_3)_2N_4O_2$. *Manufacture:* From the seeds of *Theobroma Cacao* and from xanthine, which is a substance closely related to uric acid. It is in colorless bitter crystals, sparingly soluble in water, alcohol, or ether. See page 398.

Caffeine. Caffeina (Theine).—Tri-methyl Xanthine, $C_5H(CH_3)_3.N_4O_2 + H_2O$.—(*Official.*) See page 547.

Theobromine Sodio-Salicylate. Theobrominæ Sodio-Salicylas. Diuretin.—Theobrominum Natrio-salicylicum, $C_7H_7N_4O_2Na + C_6H_4(OH)COONa$.—(*Official.*) See page 400.

Diacetylmorphine Hydrochloride. Diacetylmorphinæ Hydrochloridum.—Heroine Hydrochloride, Heroinæ Hydrochloridum, $C_{17}H_{17}(C_2H_3O_2)_2NOHCl$.—(*Official.*) See page 238.

Tropacocaine Hydrochloride. Tropacocainæ Hydrochloridum. Benzoyl-pseudotropeine Hydrochloride, $C_{15}H_{19}NO_2HCl$.—Obtained synthetically from tropin by electrolytic reduction, from which get benzoyl derivative that is converted into the hydrochloride. Occurs in colorless needle-shaped crystals, melting at 271° C. (520° F.), soluble in water, solutions keeping several months; heated with hydrochloric acid splits into benzoic acid and tropine, incompatible with alkaloidal reagents.

Properties and Uses.—Local anæsthetic—resembling cocaine, but only half as poisonous, while anæsthesia is quicker and more prolonged and mydriasis much less; ophthalmology, dentistry, being applied in 3–10 p. c. aqueous solutions containing .6 p. c. sodium chloride.

Novocaine. Ethocaine. Ethocaina.—Para-aminobenzoyl-diethyl-aminoethanol Hydrochloride, $C_{13}H_{20}N_2O_2HCl$.

Occurs in colorless, needle-shaped crystals which melt at 156° C. (313° F.), soluble in alcohol (30), water (1), giving a neutral solution from which alkalies and their carbonates precipitate the free base as a colorless oil, quickly congealing to a crystalline mass—solution, however, not precipitated by sodium bicarbonate nor decomposed by boiling.

Incompatibles: Alkalies, alkali carbonates, alkaloidal reagents (potassium mercuric-chloride, potassium iodide, picric acid, etc.).

PROPERTIES AND USES.—Local anæsthetic, non-irritating; similar to cacaine, but does not cause hyperæmia or necrosis of tissues, and much less toxic than it or any of its other substitutions. Dose, infiltration anæsthesia—gr. 4 (.2 Gm.) with physiological salt solution ℥ 1.6–3.2 (50–100 Gm.), with or without suprarenal alkaloid solution (1 in 1,000) ♏v–10 (.3–.6 Ml. (Cc.)): for injections—gr. 1.5 (.1 Gm.) in salt solution gr. 75–150 (5–10 Gm.), with or without suprarenal alkaloid solution (1 in 1,000) ♏x (.6 Ml. (Cc.)): ophthalmology—1–5–10 p. c. solutions; rhino-laryngology—5–20 p. c. solutions with suprarenal alkaloid solution ♏vi–8 (.4–.5 Ml. (Cc.)) in each ♏clx (10 Ml. (Cc.)); internally—gr. 5–8 (.3–.5 Gm.).

Novorenal—name applied to sterilized solutions of various strengths of novocaine + adrenalin in normal salt solution for dental surgery.

Euquinine. Quininæ Æthyl-carbonas. Quinine Ethyl-carbonate. Euchinin, $C_{23}H_{28}N_2O_4$. Obtained by the action of chlorocarbonic ethyl ester on quinine. Occurs in tasteless, odorless, light fleecy, white, needle-shaped crystals, melting at 95° C. (203° F.), soluble in alcohol, ether, chloroform, sparingly in water, slightly alkaline, with acids forming crystalline bitter salts—tasteless tannate—incompatible with acids which develop bitter quinine taste.

PROPERTIES AND USES.—Similar to quinine, with the advantage of being tasteless; malaria, intermittents, pneumonia, pleurisy, whooping-cough. Dose, gr. 15–30 (1–2 Gm.), daily; malaria, gr. 40 (2.6–Gm.), in syrup or milk.

Saloquinine and *Saloquinine Salicylate* are salicylic esters of quinine, containing about 73 p. c. of that alkaloid, for which, owing to lack of taste, they are good substitutes.

Stovaine. Stovainum. Benzoyl-ethyl-dimetylaminopropanol Hydrochloride, $C_{14}H_{21}O_2NHCl$.

Manufacture: React with benzoyl chloride on *a*-dimethyl-amino-pentonal-*b*, a substance produced by the action of ethylmagnesium chloride on methylamino-acetone. Occurs in small brilliant crystals (scales), melting at 175° C. (347° F.), soluble in alcohol, water, the latter solutions being slightly acid and sterilized at 115° C. (239° F.), without decomposition, precipitated by alkaloidal reagents and decomposed by dilute alkalies.

Properties and Uses.—Local anæsthetic similar to cocaine, but dilates bloodvessels, whereas cocaine contracts them; heart tonic, but only one-half as toxic as cocaine. Dose, gr. $\frac{1}{30}$ (.002 Gm.), in pill; locally in the eye 4 p. c. solution, on other mucous membranes (laryngology, etc.) 5–10 p. c. solutions; hypodermic injection (local anæsthesia) 1 p. c. solution.

Opsonins. Bacteria Vaccines. Opsonic Theory.—It is claimed that the blood fluids so modify bacteria germs as to render them readily devoured by the white blood-corpuscles (leukocytes, phagocytes), and the elements in the blood fluids causing this effect are called opsonins. These are supposed to act by chemically uniting with and changing the invading bacteria so that they become absorbed by the leukocytes, which are themselves neither stimulated nor otherwise affected. Opsonins in the blood plasma are of many varieties, each special in combating a particular kind of bacteria, while leukocytes of healthy and diseased persons are active alike in the same serum, so that the amount of opsonins present in the blood determines an individual's susceptibility to bacterial invasion.

For treatment must (1) isolate in pure culture the causative micro-organism, (2) estimate opsonic power of patient's blood to this micro-organism, (3) prepare and standardize a vaccine from this micro-organism—provided the opsonic index be at or below normal, (4) inoculate patient with proper dose and frequency of this vaccine, as shown by a systematic estimation of the opsonic content of the patient's blood.

The starting point of opsonins are 24-hour pure cultures of the peculiar disease micro-organism causing the particular disease for which the vaccine is given, the culture being removed from the surface of the media by small quantity of sterile salt solution, which holds the germs in suspension. The number of germs in salt suspension is compared with the number of red corpuscles in same quantity of human blood, the density being adjusted by the operator according to his needs in fixing the number of germs for a dose.

Uses.—Tuberculous joints, septicemia, endocarditis, Malta fever, etc. The number of micro-organisms for a dose depends upon the disease, condition of patient, and virulency of the micro-organism used in preparing the vaccine: Staphylococcus vaccine—three hundred millions; pneumococcus and streptococcus—fifty millions; Gonococcus—ten millions; Tubercle (T. R.)—$\frac{1}{3000}$–$\frac{1}{800}$ of a milligram.

Roentgen Rays. *x*-Rays. Radio-activity.—If electric sparks be passed between the poles of a highly exhausted glass tube (Crookes') a faint, straight-lined radiation (cathode rays) emanates from the cathode, which consists of a stream of very minute, rapidly moving, negatively charged particles. These cathode rays impinge on the walls of the tube, producing a brilliant fluorescence, while at the same time a new kind of rays (Roentgen- or x-) pass out in straight lines from the walls of the tube, which are invisible, not easily deflected by a magnet, but very efficient, causing many substances to become luminescent, passing through bodies opaque to ordinary light waves, affecting photographic plates, producing physiological effects on living tissues, and changing insulating media (air, gases, paraffin, etc.) into conductors when passing through them.

Inasmuch as Crookes' tubes are fluorescent while emitting x-rays, it was thought that the latter might be given out, possibly, by various fluorescent bodies. Uranium salts, noted for their fluorescence after exposure to sunlight, were found to affect sensitive plates covered with black paper impervious to ordinary light. Becquerel, working along this line, placed some double sulphate of uranium and potassium on a covered photographic plate, but, owing to a sudden storm obscuring sunlight, thus rendering impossible the exposure of the uranium salt to the sun for the production of fluorescence, he laid away carefully in a dark drawer the plate with the uranium salt upon it. Some days afterward he happily decided to examine this same plate for possible changes, and in the development, much to his surprise, found that it had been affected greatly, thereby discovering the remarkable radiation —Becquerel rays or radio-activity. Any substance, therefore, which like uranium, emits such invisible rays, that affect a photographic plate or pass through opaque substances, is said to be *radio-active.* Madame Curie found in uraninite (pitchblende, a complex substance, and the source of uranium salts) several elements—polonium, actinium, radium—far more radio-active than uranium and its salts.

Radium, although never yet isolated (only 1 Gm. of the salts existing at a cost of $6000), is an alkaline earth resembling barium, with a radio-activity 100,000 times stronger than that of uranium; its salts (bromide, chloride, sulphide) are white, crystalline, grayish in time, self-luminous, imparting luminosity (phosphorescence) and radio-activity to neighboring bodies temporarily, emit heat constantly, reduce silver salts and mercuric chloride, convert white to red phosphorus, and color glass, porcelain, paper, rock-salt, just as cathode rays do.

As sun rays consist of rays of light, heat, and actinic power, so radio-active bodies possess three kinds of rays: *alpha* (α)—having slight penetrating power (completely absorbed by a few centimeters of air or a sheet of paper), being deflected with difficulty by a magnet and consisting of a stream of particles, twice as heavy as the hydrogen atom, positively charged, moving at great velocity; it is to the bombardment of these particles that the self-heating of radium salts is believed to be due; *beta* (β)—having a marked power of penetration and of exciting phosphorescence in a large number of substances (barium platinocyanide, zinc sulphide, etc.), being deflected easily by magnet, similar in character to the cathode rays and consisting of streams of negatively charged "corpuscles" or "electrons," one-thousandth part of the mass of the hydrogen atom, moving at great velocity; *gamma* (γ)—being a very penetrating kind of Roentgen rays, produced at the moment of sudden expulsion of the *beta* rays, and capable of penetrating a foot-thickness of iron.

Properties and Uses.—Rays of radium salts and *x*-rays closely resemble. Chiefly in lupus, cutaneous tuberculosis, superficial epithelioma—the radium salts being applied locally to the affected part in a small rubber bag, box, disc, or cylinder. A radium salt when even thus enclosed and brought near the temple or closed eyes causes the sensation of light, and although no portion of the body can detect its presence, yet a strong influence, similar to *x*-rays, is exerted upon the tissues. The skin often does not redden until weeks after the exposure, when intractable sores may result, while a small quantity sealed in a glass tube will kill fish when placed into a bowl containing them. The extreme expense and lack of uniformity of the radium salts restrict greatly their use.

PART VI.

THE MICROSCOPE AND ITS USE IN MATERIA MEDICA.

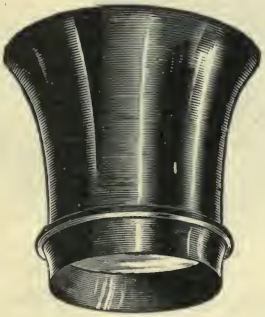
ALTHOUGH it is impossible for all druggists to become experienced with the microscope, yet every one, by a little patience, study, and tact in its use, may learn sufficient to have it serve him often to advantage. One readily admits the importance of such knowledge when he observes that the skilful manipulator, in many cases, shares equal honors with the chemist in determining qualitative (sometimes quantitative) analyses of various substances—in fact, a number of plant-constituents, as starches, oils, acids, sugars, crystals, alkaloids, etc., yield in the hands of chemists and microscopists similar and equally satisfactory results. While it is not the intention here to go very deeply into the subject, it is, however, desired to give that which the average pharmacist, if so disposed, can put with profit into practice. Special laboratory course or various treatises pertinent to this department should be availed of for more extended information.

I. DESCRIPTION OF THE MICROSCOPE.

Of these there are two kinds—simple and compound.

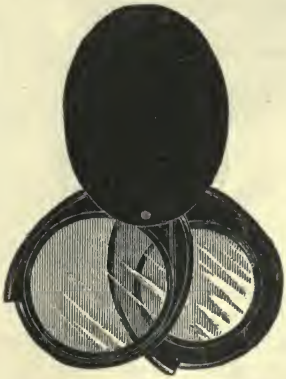
The Simple Microscope is only a hand magnifying-glass or linen-tester, and consists of a double convex lens (or several mounted in juxtaposition on a common axis), giving an extensive field of view and an erect

FIG. 469.



Simple microscope (watchmaker's).

FIG. 470.

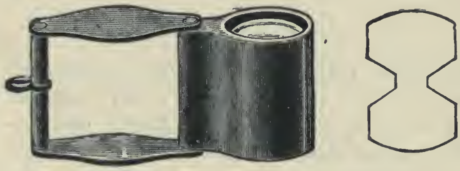


Simple microscope (magnifier).

image 5–30 times the size of the object. This instrument is valuable in field botanic work, crystallography, deciphering illegible prescriptions, recognizing various fabrics and other objects indistinctly visible by the naked eye.

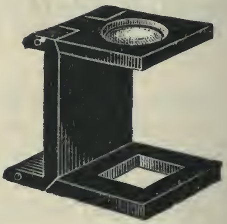
The Compound Microscope is a more complex instrument, and consists of several lenses so separated at focal distances that each one serves to magnify the image transmitted by the preceding one. The higher the magnifying powers used, the smaller becomes the area of the object that is seen through the instrument, and the light being correspondingly diffused over a larger area in the image, the latter appears less bright. The image is always inverted and magnified 10–4,000 times.

Fig. 471.



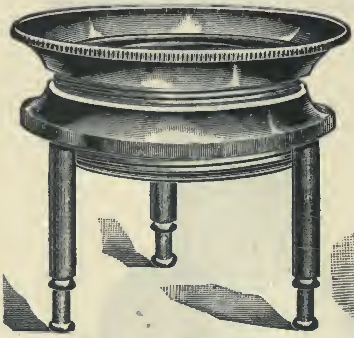
Simple microscope. (Coddington.)

Fig. 472.



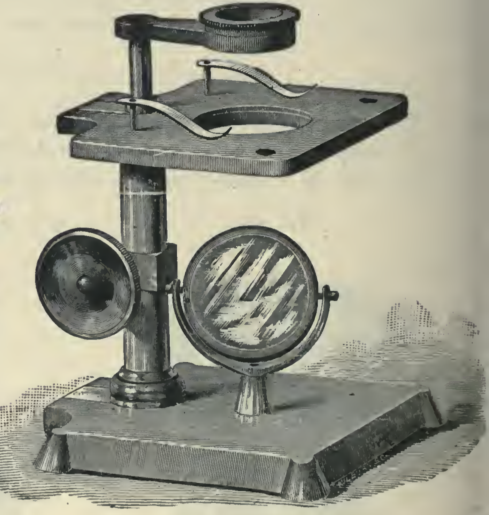
Simple microscope (linen-tester).

Fig. 473.



Tripod dissecting microscope.

Fig. 474.

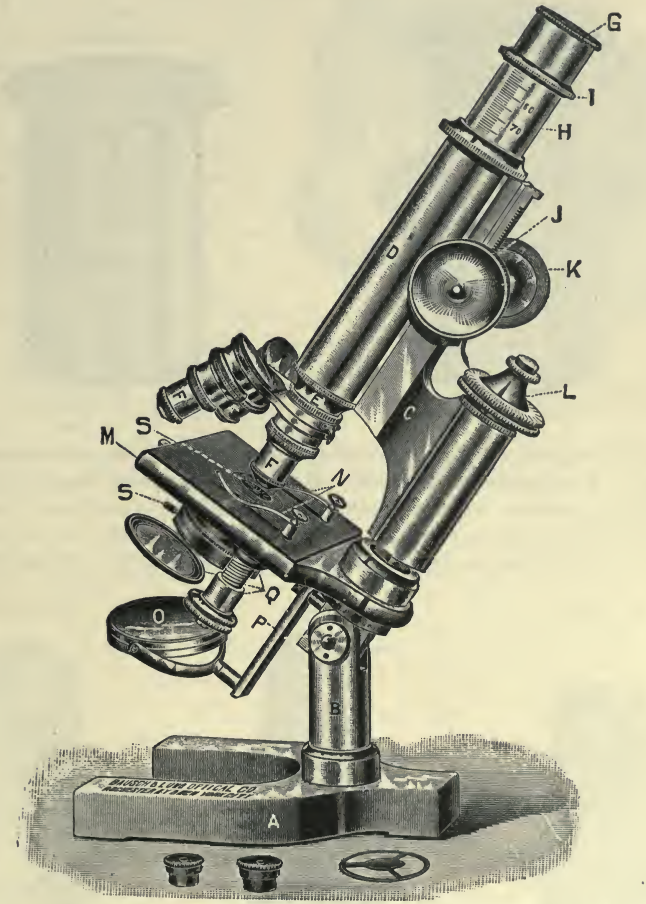


Folding dissecting microscope.

1. *The Ocular or Eye-piece* (G).—This, in the line of vision, is the part nearest to the eye, and has several types—Huyghenian, Conti-

nental, Kellner, Binocular, Solid (all negative), Ramsden, etc. (positive). The first named is used mostly, and consists of two plano-convex lenses (plane surfaces upward) mounted in a short metal tube: the one next to the eye—eye-lens; the one farthest—field-lens. Between these two a diaphragm is so placed as to cut off the blurred

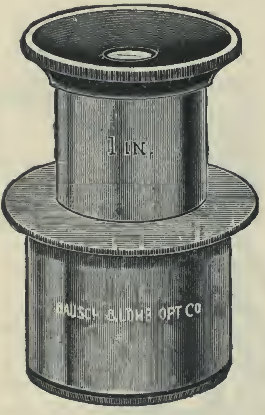
FIG. 475.



Compound microscope. A, base; B, pillar; C, pillar and arm; D, body; E, nose-piece; F, objective: G, ocular: H, draw-tube; I, collar; J, rack and pinion; K, coarse adjustment: L, fine adjustment; N, spring clips; O, mirror; P, mirror bar; Q, diaphragm and substage; R, substage screw; S, stage aperture; T, pillar hinge-joint.

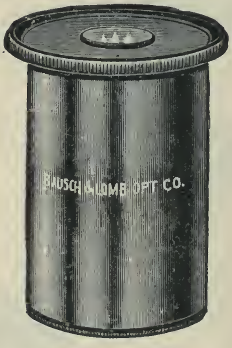
edges of the image, thus giving a flat field and a sharp, round outline to the field of vision. The ocular magnifies the real image produced by the objective as though that image were itself the original object; its magnifying power is inversely proportional to the length—the longer the tube, the lower the power. Oculars are designated as follows: A–2 inch, B–$1\frac{1}{2}$ inch, C–1 inch, D–$\frac{3}{4}$ inch, E–$\frac{1}{2}$ inch—the first weakest, the last strongest.

Fig. 476.



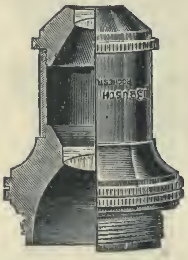
Ocular (Huyghenian).

Fig. 477.



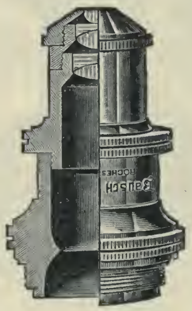
Ocular (Continental).

Fig. 478.



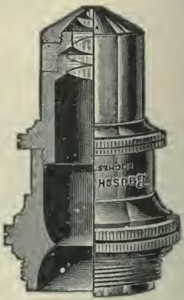
Objective, $\frac{2}{3}$-inch.

Fig. 479.



Objective, $\frac{1}{8}$-inch.

Fig. 480.

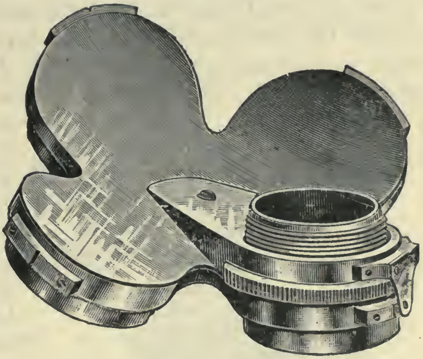


Oil-immersion objective, $\frac{1}{12}$-inch.

2. *The Objective* (F).—This, in the line of vision, is removed farthest from the eye and is the most essential portion of the instrument; to its many improvements (also further susceptibilities) are (and will be) due the great advancements in vegetable and animal histology. It consists usually of a front plano-convex lens (convexity upward), together with one, two, or three others, which may vary in shape between plano-convex, concavo-convex, and bi-convex (according to manufacture), working in combination as a single magnifier, thus producing an enlarged inverted and reversed image—this simple image being that which the ocular receives, and in turn magnifies. Objectives may be either *dry* or *immersion*, according as they are used without or with a drop of liquid between the lens and the object; if the liquid used has same refractive power as the glass lens, then it is

called *homogeneous immersion.* Objectives are known by whole numbers and fractions, thus: 4 — 3 — 2 — 1½ — 1 — ¾-inch = lower power; ¼ — ⅕-inch = medium power; ⅙ — ⅛ — $\frac{1}{10}$ — $\frac{1}{12}$ — $\frac{1}{16}$ — $\frac{1}{20}$ — $\frac{1}{25}$-inch = high power, all of which are but expressions for intrinsic focal distance; a 1-inch objective, hence, has the same magnifying power as a simple lens with 1-inch focus, etc. The strength is inversely as these figures—smaller the fraction the greater the magnifying power, also smaller the end lens the greater the power; whereas working-distance, field of view, and amount of light are all directly as these figures—becoming less as the fraction diminishes. Objectives of low power, 2–1-inch, serve best for pharmacists, as these afford good working distance, hence the inspection of most objects without risk of injuring the lower lens.

Fig. 481.



Objective nose-piece.

The following table shows approximate magnifying powers of oculars and objectives taken conjointly under the indicated combinations:

Oculars.	Objectives.												
	3 in.	2 in.	1½ in.	1 in.	⅔ in.	½ in.	¼ in.	⅕ in.	⅙ in.	⅛ in.	$\frac{1}{10}$ in.	$\frac{1}{12}$ in.	$\frac{1}{16}$ in.
A—2 inch.	11	16	23	30	55	88	190	230	265	345	382	580	820
B—1½ "	16	22	33	41	74	120	260	315	340	460	525	810	1100
C—1 "	21	30	44	53	96	155	355	410	450	590	701	1060	1420
D—¼ "	28	40	56	69	130	200	455	550	585	770	900	1400	1860
E—½ "	35	54	70	85	165	265	560	710	750	980	1110	1760	2350

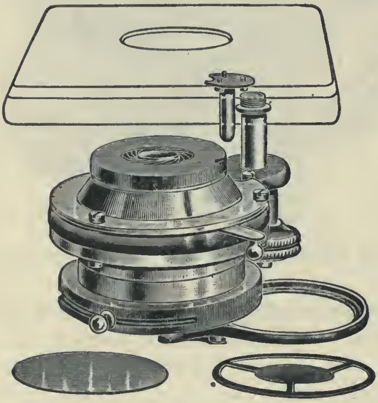
This compilation is based upon tube length being 160 Mm.—6$\frac{3}{10}$ inches; for instruments whose tube length is 216 Mm.—8½ inches—an increase of about 25 p. c. must be added in each case.

Several higher objectives are made—$\frac{1}{40}$—$\frac{1}{50}$—$\frac{1}{80}$-inch, which magnify 2,000–5,000 diameters according to ocular used. These all contain, in addition to the 2–4 lenses for magnifying, a combination of lenses for correcting chromatic and spherical aberrations, the most of which, however, is compensated for by the opposite aberration of the ocular.

Chromatic Aberration.—The lens proper is not only a magnifier, but also a prism; owing to this latter fact a ray of light in passing through it is deflected from its course and resolved into its elementary colors, thus giving, unless rectified, colored marginal bands around the image of the objects examined. This chromatic defect is overcome satisfactorily by a combination of lenses having opposite aberrations, namely, a convex crown lens and a concave flint lens, acting together as a single convex lens.

Spherical Aberration.—The convex lens, being in the nature of a prism, refracts rays of light toward the axis of the lens, but as the angle of the lens is greatest at the edge and gradually diminishes toward the centre, where the faces are parallel, the rays of light going through the edge of the lens are refracted more and come to a focus nearer the centre of the lens; hence there is a want of focus of the rays, or spherical aberration. This defect interferes with the defining power—*i. e.*, the definition of the image—the image of a flat object becoming curved and blurred around its edges, so that in examining netted fabrics the central fibres are straight and distinct, the outer curved and indistinct. This spherical defect may be corrected by a diaphragm which cuts off border light by contracting the central aperture.

FIG. 482.



Screw substage.

3. *The Body* (D).—This consists of the two long telescoping tubes: the outer—the sleeve; the inner—the draw-tube. To the upper end of the body (draw-tube) is attached the ocular, to the lower end the objective.

4. *The Stand* (A, B, C, etc.).—This is all the remaining portion of the instrument, and its various parts have received distinctive names, thus: A, base or foot—variously shaped (triangular, horseshoe, or circular), and sufficiently heavy to insure steadiness; B, pillar—portion above and below the stage, often jointed; C, arm; E, nose-piece—double, triple, or quadruple, into which several objectives are screwed, so that by turning either may be brought into visual position; F, objective; G, ocular; H, draw-tube; I, collar; J, rack and pinion; K, coarse adjustment; L, fine adjustment, both worked by a milled screw; M, stage; N, spring clips; O, mirror—with concave and plane surfaces, the former being used mostly; Q, diaphragm and substage; R, substage screw; S, stage aperture and substage; V, Abbé condenser—gives more light to objective, being of special service when examining stained specimens, which are recognized chiefly by color and not by outline.

II. REQUISITES OF A GOOD MICROSCOPE.

Almost any make of high-grade instrument will give satisfaction that has the following qualities:

1. It should possess firmness and solidity through its base, pillar, arm, etc.

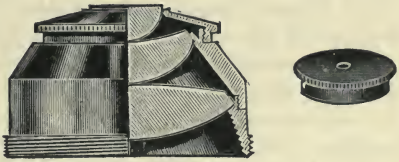
2. It should have a good-sized stage, preferably square, thick, firm, of glass, metal, or vulcanite.

3. It should have coarse and fine adjustments, worked by rack and pinion; both should move evenly, smoothly, promptly, without wobbling.

4. It should possess working distance; thus the higher objective when in focus should leave sufficient space above the stage for the introduction of slides, etc., without danger of contact. The longer the working distance, the less will the distinctness of the image formed be affected by any given alteration in its focal adjustment. Lenses with greatest working distance have most focal depth.

5. A nose-piece is essential in order to economize time and facilitate work. This may be either double, triple, or quadruple, and is an appliance fitting the tube's extremity for carrying 2, 3, or 4 objectives, of varying power, any one of which may quickly be brought into direct position by turning the arm on a pivot.

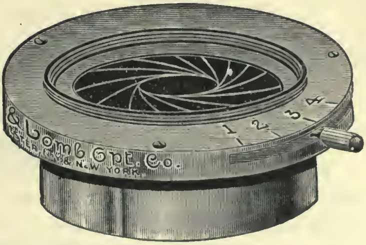
FIG. 483.



Abbé condenser.

6. The penetrating power (focal depth or range of focus) should be considerable. This quality, though not necessary for very thin sections, enables one to see the parts of an object not exactly in focus with sufficient distinctness to allow their relations with what lies exactly in that plane to be clearly traced out. Thus one lens may only for an instant give a sharp focus at a limited distance from the object, while another lens may give a good image at a considerable distance above and below the best focal point; the first kind of lens prevents us from ascertaining the relation of the higher layers of an object to the lower unless we continually follow the focus with the fine adjustment; the second kind of lens, having greater penetration, brings a thicker portion of the object into view at the same time—the greater the penetrating power, the better the microscope.

FIG. 484.



Iris diaphragm.

7. Flatness of the field varies with the magnifying power and angle of aperture of the lens. Here all parts of the field are in focus at the same time, so that the image is distinct over the whole field at once without marginal color. This requisite should be tested for under an eye-piece giving a large aperture.

8. The distinctness of the image (defining power) should be good;

this depends upon the complete correction of chromatic and spherical aberrations, and upon the accurate centering of the lenses, otherwise the outer borders will be blurred.

9. Resolving power, by which very minute and closely approximated markings, lines, striæ, dots, and apertures can be discerned separately; the maximum capacity thus far attained being the separation of 118,000 lines per linear inch. These three last qualities are very essential.

III. DIRECTIONS FOR USING THE MICROSCOPE.

1. For working, select a northern window; this insures the greatest amount of reflected light possible from white clouds. Never use direct sunlight, and if possible avoid artificial light. If southern exposure alone is available, have window-blind, and that well drawn.

2. The instrument should be placed between the operator and the window, and, all working parts being in order, the mirror and lens to be used should be wiped with soft chamois leather.

3. The body of the microscope should be about vertical, so as not to interfere with mounting in fluid media; the mirror should be adjusted to reflect light through the instrument, using plane side for parallel rays and concave side for divergent rays.

4. Having inserted objectives into the nose-piece, place object for examination in the centre of the slide under the cover-glass, and this as near the middle of the stage as possible; adjust light by mirror and diaphragm, and focus with coarse adjustment.

5. Make all first examinations with low power and large diaphragm aperture, at least the one yielding distinct vision; then follow with higher powers and smaller apertures. The power should always be increased at the objective first, observing the following combination:

Ocular.	Objective.	
2 inch	$\frac{2}{3}$ inch	= low power.
2 "	$\frac{1}{8}$ "	= medium power.
$1\frac{1}{2}$ "	$\frac{1}{8}$ "	= high power.

6. Hold and adjust slides with thumb and forefinger of left hand; manipulate coarse and fine adjustments with right hand.

7. To focus, turn the objective down toward slide by means of coarse adjustment, short of contact; then with eye over the ocular focus backward until object is in view; from this point the exact focus can be made by one turn of the fine adjustment. With high powers focus in the same way, never allowing lower end lens of objective to come in contact with cover-glass or any liquid, as such carelessness usually results in injury to object and objective. When properly focused, work fine adjustment slightly forward and backward during observations, to get a series of optical sections of the object; also move slide on stage to bring in view different parts.

8. Never lift slides from stage, but gently slide them off without upward movement. Previous to doing this the tube should be raised out of focus, especially with high powers.

9. Accustom yourself to use both eyes indifferently, and when one is in use keep the other open—never closed; this can soon be acquired with a little practice.

10. In examining powdered specimens, a very small amount is placed upon a slide centrally, a drop of water or glycerin added with a pipette; now put over this with forceps (slantingly to avoid air-bubbles) a cover-glass, using slight pressure on it after it is in proper position, and absorb superfluous fluid with camel's-hair pencil or blotting-paper.

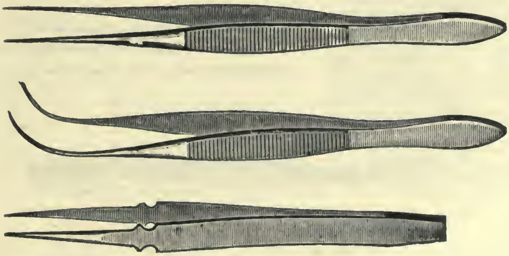
11. If specimen be tissues of which cross-sections are to be taken, use for this purpose a razor or microtome (the latter only in experienced hands). The razor should have lower surface flat, upper slightly hollow-ground; should be sharp, opened in straight line with handle, and sections made by pulling from heel to toe, using in the sliding cut considerable edge length. Both razor and object should be wet while cutting, to prevent adhesion and admission of air; if material is fresh, use for it water or diluted alcohol; if material has been hardened, employ same strength alcohol as used in the hardening process.

12. Hold objects between the forefinger and thumb, allowing the razor to rest upon the former, when the sliding cut can be made. Sections should be cut as thin as possible so as to include but one layer of cells, which proficiency can be acquired only after considerable practice. Remove sections with a camel's-hair pencil to a watch-glass containing water, and as desired arrange a section on the slide under the cover-glass with a drop of water, when it is ready for examination and the introduction of various reagents. If object be too small for such handling, it should be imbedded in some relatively hard substance—dried elder pith, cork, paraffin, etc., and then cross-sections taken as before, but through the combined mass.

IV. ACCESSORY APPARATUS AND REAGENTS.

1. A pair of fine-pointed forceps for handling cover- and watch-glasses, small objects, etc.

FIG. 485.



Dissecting-forceps.

2. A pair of fine scissors, sharp-pointed and bent, for dividing tissues, etc.

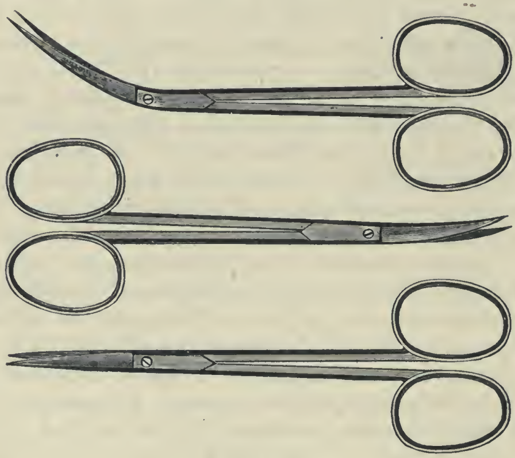
3. A pair of dissecting-needles for teasing tissues apart, etc.

4. A good razor, under side flat, upper slightly concave, edge straight, also strop and hone.

5. A supply of glass slides 3 x 1 inch, with ground edges, also cover-glasses, square or circular, $\frac{3}{4}$–$\frac{7}{8}$ inch, section-lifters, etc.

6. Watch-glasses (flat bottom) in which sections are to be bleached, stained, etc.

FIG. 486.



Dissecting-scissors.

7. Graduated ruler for drawing and estimating magnifying power.

8. Camera lucida for drawing, the Abbé being the best.

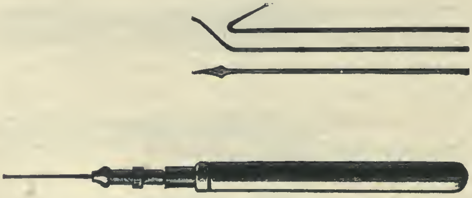
9. Spirit lamp, racks for holding slides and reagent bottles.

10. Pipettes, glass rods, camel's-hair pencils, blotting-paper, chamois.

11. Micrometer adapted either to the eye-piece or stage, or to both.

12. Turn-table with self-centering device, for mounting and finishing slides.

FIG. 487.



Dissecting-needles.

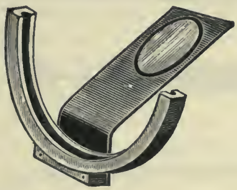
13. Caustic potash—2–5–10 p. c. solutions, used to dissolve proteids, starch, to swell cell-walls, etc.

14. Acetic acid (glacial), 1–2 p. c. solutions, for defining nucleus, clearing cell-contents, in staining, and to distinguish calcium oxalate from calcium carbonate—the latter dissolving with effervescence.

15. Sulphuric acid, 92 p. c.—dissolves starch and cellulose, converting them into dextrin and amyloid, respectively; diluted acid (10 p. c.)—serves to identify crystals in cells. Thus calcium oxalate, carbonate, phosphate, and malate, all are converted into needles of calcium sulphate, while sphere crystals of inulin, resembling calcium phosphate, are dissolved completely.

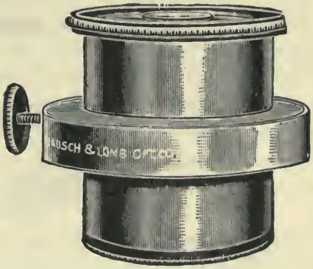
16. Hydrochloric acid—as a clearing agent, with phenol, thymol, aniline chloride, etc.; also to distinguish calcium oxalate from carbonate (dissolves latter with effervescence, the former slowly without effervescence); also to modify overstained sections from hæmatoxylin, carmine, and aniline solutions.

FIG. 488.



Camera lucida (brass mounted).

FIG. 489.



Ocular micrometer.

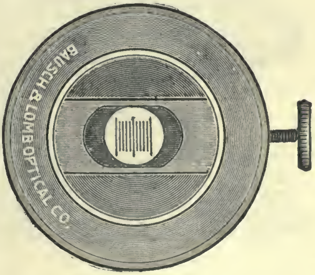
17. Nitric acid, 68 p. c.—causes protoplasm to shrink from cell-wall, and when ammonia is added afterward we have the middle lamella stained yellow; a 30 p. c. solution swells and finally dissolves amyloid.

18. Chromic acid (strong solution)—separates cells of thick-walled tissue, dissolving easily the middle lamella, finally the entire cell; a ½–1 p. c. solution fixes cell-contents of tissues by soaking in it 24 hours, then wash and stain.

19. Compound iodine solution (tincture iodine + potassium iodide) stains starch blue, proteids yellowish-brown, lignified cell-walls deep brown, kills protoplasm without dissolving it, is a fixing agent, and with H_2SO_4 becomes a test for cellulose.

20. Chlor-zinc-iodine (Schulze's solution) — colors cellulose blue, lignified and cutinized tissues brown, starch is turned blue, swells and dissolves; swells cells-walls and stains protoplasmic threads brown, therefore is used in studying continuity of protoplasm from cell to cell.

FIG. 490.



Sectional view of ocular micrometer.

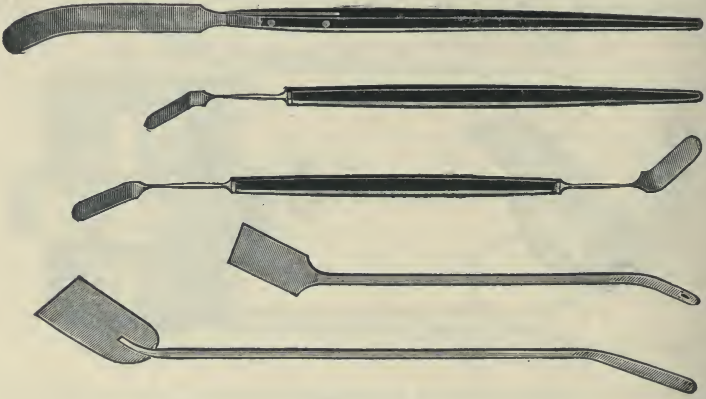
21. Aniline chloride, colorless, 5 p. c. alcoholic solution, or saturated aqueous solution + sufficient HCl to acidify—stains lignified tissues deep yellow, but does not affect cellulose and cutinized tissues.

22. Fehling's solution—with grape-sugar a red color is obtained. If cane-sugar be present, a bluish or greenish color appears.

23. Ammonio-ferric alum—with tissues containing tannin gives bluish-black or greenish-black precipitate.

24. Silver nitrate, 2–3 p. c. solution—develops the laminæ in starch-grains and in thick-walled cells.

Fig. 491.



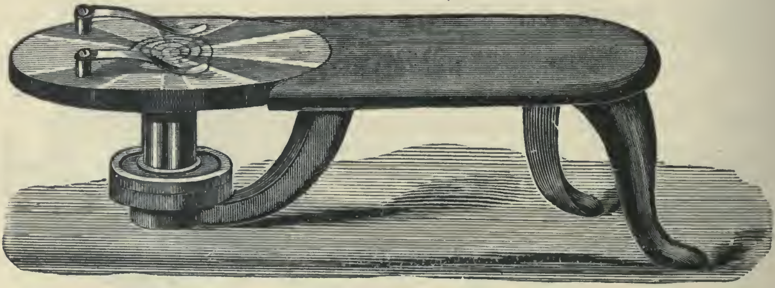
Section-lifters.

25. Diphenylamine solution—turns tissues blue that contain nitrates.

26. Sulphuric ether—dissolves out oils, resins, fats, etc.

27. Alcohol—preserves tissue, dissolves chlorophyll, coloring-agents, resins, oils; also bleaches.

Fig. 492.



Turn-table.

28. Phenol (carbolic acid)—useful clearing agent, can mount directly from this solution.

29. Glycerin—for clearing sections, preserving tissues for temporary or permanent mounting.

30. Canada balsam—for permanent mounting.

V. SOME ADVANCED MICROSCOPIC METHODS AND APPLIANCES.

1. *Estimation of Magnifying Power.*—While the table given on page 899 is of interest and service, yet, owing to slight variations therefrom in almost every microscope, each operator always prefers to test his own by one or all of the following methods:

(*a*) By taking absolute measurements. Ten inches are recognized generally as the normal length of distinct vision with the naked eye. Now, suppose the distance from an object in focus to the upper end of ocular is 10 inches, and that the 2-inch ocular and 1-inch objective are in service, we will then have the ocular focusing at 2 inches what the eye does in 10, or it magnifies 5 diameters—$10 \div 2 = 5$; also the objective focusing at 1 inch what the eye does in 10, or it magnifies 10 diameters—$10 \div 1 = 10$; consequently these two combined—$5 \times 10 = 50$, which is the total magnification of the instrument as arranged. If we use 1-inch ocular and $\frac{1}{5}$ objective, we have $10 \div 1 = 10 =$ magnification of ocular alone; $10 \div \frac{1}{5} = 50 =$ magnification of objective alone; hence the two combined—$10 \times 50 = 500$ diameters $=$ combined magnification.

(*b*) By a stage micrometer and a 2-inch boxwood rule. This micrometer is but a glass slide having 1,000 ruled lines to the inch. When this is focused and the rule placed in front of and parallel with it on the stage, we can compare the two simultaneously by looking at the micrometer through the microscope with one eye and at the ruler with the naked eye. If the micrometer spaces now appear $\frac{1}{2}$ inch apart, the magnifying power is 500 diameters; if 1 inch apart, then 1,000 diameters.

(*c*) By stage micrometer and camera lucida. This gives greater accuracy, and is accomplished by focusing stage micrometer and placing a camera lucida on the eye-piece. To one side in same plane as stage place a sheet of white paper at right angles to the object viewed, and upon this will be projected the image of the lines, which then can easily be drawn and the distance between any two measured. Suppose they are $\frac{1}{5}$ inch apart; now those on micrometer are $\frac{1}{1000}$ inch apart, hence magnifying power is 200 diameters—$\frac{1}{5} \div \frac{1}{1000} = \frac{1000}{5} = 200$. Instead of the camera lucida, an eye-piece micrometer in conjunction with the stage micrometer can also be used with equal if not better results.

2. *Hardening.*—If tissues to be examined are not sufficiently firm to allow satisfactory cutting—as tender parenchyma of non-vascular plants, they should be hardened by soaking several hours in diluted alcohol, then in pure alcohol. The employment of several alcohols varying in strength prevents tissue-contraction by osmotic action. Alcohol here dissolves resins, volatile oils, chlorophyll, thus acting as a bleaching agent. It coagulates and kills protoplasm without impairing its structure, also renders it more opaque, when it may readily be stained with the various fluids; it also dehydrates tissues previous to being mounted in Canada balsam.

3. *Softening.*—All dry and hard substances should be softened before sections can be made properly. In the case of roots, rhizomes, tubers, corms, fruits, seeds, etc., they are soaked first in alcohol half an hour to expel air, then in water several hours or until saturated (hard tissues, shells, etc., may require several days); if now too soft for cutting, lay in alcohol 24 hours; if again too hard or brittle, place in a mixture of equal parts of alcohol and glycerin for 24 hours. In such roots as gentian, etc., that are much shrunken, we should use for water in second stage a 1–2 p. c. aqueous solution of potassium hydroxide or ammonia; this alkali, however, should always be washed out with water before hardening. Specimens thus prepared can be kept always in readiness by letting them remain immersed in a mixture of equal quantities of alcohol and glycerin.

4. *Clearing.*—It is often necessary to clarify sections by having absorbed from them such substances as would prevent transparency—starch, resins, oils, etc. To accomplish this, sections should be boiled in water and put into diluted Labarraque's solution for 15 minutes, or placed for a short while into a mixture of 4 parts oil of turpentine + 1 of creosote, or into pure oil of cloves, then mounted in Canada balsam. When sections have been stained, should soak them first in alcohol for a few minutes and then in the clearing-mixture.

5. *Staining Fluids.*—These make prominent and differentiate thin cell-walls, inconspicuous and uniform tissues, etc., thus making their differences in appearance very perceptible.

(*a*) Hæmatoxylin. Prepared by mixing 2 parts saturated alcoholic solution hæmatoxylin with 75 parts saturated aqueous solution ammonia alum; let stand a week in sunlight, filter, and to every 7 parts add 1 part each of glycerin and methyl alcohol, allow sediment to deposit by standing, filter. Used to stain lignified and cellulose walls—not cutinized ones; is also a good nuclear stain. Sections should soak several hours—those from alcohol should first be washed and all acids avoided.

(*b*) Fuchsin. A solution of fuchsin in water, used to stain lignified cell-walls, as these hold color better than non-lignified ones. When sections with fuchsin staining are washed with a mixture of saturated solution of picric acid 1 part + water 2 parts, the fuchsin is removed from unlignified cell-walls, while lignified ones remain beautifully stained. These may now be dehydrated and mounted, or double-stained with aniline blue, then dehydrated and mounted.

(*c*) Methyl-green. An aqueous solution of methyl-green sufficiently strong to give deep green color. It stains protoplasm, nucleus, also lignified and cutinized tissues better than it does cellulose. Tissues absorb color quicker if previously washed in weak acidified (HNO_3) water.

(*d*) Iodine-green. Made by dissolving iodine-green in water until a deep green solution results. This stains lignified and cutinized tissues green, also proteids, amyloplasts attached to young starch-grains; acts on cellulose tissues slightly. Often used with carmine, eosin, or fuchsin for double staining.

6. *Mounting.*—When for only temporary or immediate use, water or glycerin, or a mixture of the two, is employed. If it is to be permanent, then Canada balsam is the best medium. Mounting is accomplished thus: The sections, if stained in aqueous solution, should first be dehydrated by placing for a few minutes in 70 p. c. alcohol, then in 90 p. c., and finally in 98 p. c.; now put for a short while in clearing medium—oil of cloves or oil of turpentine—place a section on centre of slide, add to it a drop of balsam, apply cover-glass slantingly to avoid air-bubbles, slightly tapping same to a fixed position. If just sufficient balsam is used, we have simply to let it dry several days, then ring with a circle of colored cement around marginal contact of cover-glass with slide.

VI. The Microscope in the Drug-store.

While it is true that many official drugs come to us with adulterations and sophistications, yet in order to identify such with the microscope one should be perfectly familiar with the appearance of the pure drug. In order to be certain of reliable results, he should examine at least a dozen samples taken from various portions of the substance in question. In examining cross-sections of drugs in their original entire form we should know the arrangement as well as character of all the composing tissues, by which alone identification and recognition can be assured. In examining powders we have the most difficulty, as quite all the original characteristics are much changed or destroyed by comminution. Here, however, a sample of the crude article as powdered by one's self is to be compared with the specimen under consideration. Should the direct observance of a powder through the various objectives give little satisfaction, then micro-chemical reagents can, in regular sequence, be added with, as a rule, good results. By an examination with the microscope alone we can recognize readily the border-pits, so characteristic of gymnospermous plants (savin, etc.), when mixed with angiospermous powders. Again, a powder may contain, as a natural constituent, the very thing with which it is adulterated mostly (starch in black pepper, etc.); in all such cases the abnormal quantity present will show conclusively the fraudulent addition; again, resins, oil-globules, crystals, starch, etc., may be observed as present, and yet not a true constituent; such should excite suspicion and lead to application of further specific tests; again, the kind of delicate hairs as characteristic of certain plants can often be recognized whole or in part —unicellular or multicellular; the thickness and appearance of varying cell-walls; the individual variety of tissue, etc., often will aid also in the identification. The elementary components and contents of plant-tissues to be looked for are fragments of ducts, bast-cells, characteristic epidermal and stone-cells, cork, plant-hairs, glands, calcium oxalate crystals, starch, etc. The articles employed for adulterating, such as are known likely to occur in respective drugs should be studied separately, so that when encountered where not belonging they can easily be identified. Such adulterants may consist of mineral matter, as calcium sulphate, calcium carbonate, iron carbonate, iron oxide, clay, brick, sand, sawdust, starch, flour, rosin, wood, bark, seeds, beans, peas, leather, cocoanut shells, exhausted and injured drugs, etc.

The following samples are but a few of the very many which any druggist may experiment with to his satisfaction and advantage.

I. Roots. 1. *Senega from False Senega.*—Soak suspected root in water until soft (10 hours), make thin cross-sections: true senega root has irregular, porous, yellowish wood; false senega root has cylindrical, porous, whitish wood. The irregularity of the structure of the cortex of senega (true) is well brought out by staining with hæmatoxylin solution. See pages 361, 364.

2. *Taraxacum from Chicory.*—Make thin cross-sections as before: taxaracum shows in the bark laticiferous ducts in many brown circles; chicory has these vessels arranged radially. The location of the laticiferous ducts is revealed readily by staining with hæmatoxylin, as they assume a darker color than the other cells on account of the dense coagulated contents of the duct. Both have deposits of inulin (which is related closely to starch) in the soft cells, which stains yellow with iodine. See pages 593, 595.

3. *Calumba from Bryonia.*—Calumba shows thick bark, small wood-bundles bright yellow, distant near the centre, in narrow rays near the bark, medullary rays broad, parenchyma filled with starch; bryonia has thin bark, cork thin, friable, wood-bundles small, numerous, in rays and concentric circles, surrounded by thin-walled parenchyma. See pages 211, 590.

4. *Belladonna from Inula.*—Belladonna has thickish bark, no bast-fibres, wood-bundles central, small, distinct, surrounded in the thicker roots by broader wood-wedges, and equally wide medullary rays; inula has a broad bark of small cells, radially arranged, with a distinct light circle of cambium between the bark and the wood area, which latter is made up of a large proportion of soft cells radially arranged and many large wood-vessels in rows. Both in the bark and the wood area there are many large openings of resin-ducts. Inula contains inulin deposited as spheres in the cells, while belladonna has much starch over the whole section. See pages 521, 602.

5. *Ipecac from Spurious Ipecacs.*—Ipecac has quite a regular bark of isodiametric cells containing starch; some of the cells contain oxalate raphides (needles), particularly in the inner bark. The wood is radiate, with medullary rays hardly distinguishable from the wood-cells in shape, but containing starch-grains. False roots have thick bark, no starch. See pages 551, 557.

6. *Pareira from False Pareiras.*—Pareira has thin bark, wood in several concentric circles, waxy cut, wood-wedges porous, uniform, numerous, separated by wavy circles of waxy parenchyma-tissue resembling medullary rays, stem with central pith. False roots have hard wood in eccentric circles, fresh cut not waxy. See page 215.

II. Rhizomes. 1. *Veratrum Viride from Cypripedium.*—Veratrum viride has one-seventh diameter in cortex consisting of parenchyma having starch, sometimes calcium oxalate, few wood-bundles, one-eighth inch from outside has brownish wavy nucleus-sheath, centre with many wood-bundles; cypripedium has thick cortex, indistinct nucleus-sheath, wood-bundles approximate, more distinct centrally, parenchyma has starch. See pages 98, 139.

2. *Arnica from Strawberry.*—Arnica has thick bark, thin cork, circle of resin-cells, wood-wedges in a close circle enclosing large pith; strawberry rhizome has no resin-cells, but contains starch. See page 612.

3. *Serpentaria from Spigelia.*—Serpentaria has thin bark containing some oil-cells, wood-wedges longest on under side, separated by broad medullary rays, pith large-celled; spigelia has thin bark, divided into two distinct layers, an inner third and outer two-thirds; wood-circle thickest on under side, radiate, continuous except usually at one end where wood is missing, medullary rays hardly visible. Pith oval and sometimes decayed; resin-spots in wood, especially around pith. See pages 169, 469.

4. *Hydrastis from Caulophyllum.*—Hydrastis has thick bark, broad wood-wedges, not fixed in number (often 10), decidedly yellow; medullary rays broad, yellow, pith large, both, like the bark, contain starch; caulophyllum has thin bark, wood-wedges not so long as in hydrastis, medullary rays broad, pith large, parenchyma contains starch. See pages 188, 210.

5. *Helleborus Niger from Helleborus Viridis.*—Helleborus niger has bark thick, circle of 8 wood-wedges, broad medullary rays, pith large; helleborus viridis has circle of 4 wood-wedges, broad medullary rays. See pages 193, 194.

III. Woods. 1. *Guaiacum from Santalum Album.*—Guaiacum consists mostly of wavy interwoven wood-fibres, numerous 1-rowed medullary rays, large single ducts and narrow lines of wood, parenchyma in 1–2 rows of irregular and interrupted circles—all cells contain resin; santalum album has ducts single, moderate size, wood-parenchyma narrow, contains volatile oil or calcium oxalate, medullary rays narrow, in 1–2 rows. See pages 167, 334.

2. *Santalum Rubrum from Hæmatoxylon.*—Santalum rubrum has large ducts, 1-rowed medullary rays, wood-parenchyma 4-rowed in interrupted, irregular circles, cells with red resinous coloring matter, parenchyma with calcium oxalate crystals; hæmatoxylon has large ducts, often in groups of 2, medullary rays 2-rowed, wood-parenchyma in broad, wavy, circular lines, coloring matter in wood-fibres and ducts. See pages 294, 308.

IV. Barks. 1. *Cinchona Calisaya from Cinchona Succirubra.*—Cinchona Calisaya has very few, if any, stone- (resin-) cells, old bark with prominent secondary cork, medullary rays narrow, bast-fibres single, sometimes in groups of 2, rarely more, medium sized; cinchona succirubra has no stone-cells, medullary rays narrow, bast-fibres medium, in lines 2 to 5, seldom 8. See pages 558, 559.

2. *Quillaja from Ulmus.*—Quillaja has crystals of calcium oxalate on the cross-section or on the broken splintery fracture, also starch-grains; slippery elm has fracture fibrous mealy, very little starch, but no calcium oxalate. See pages 158, 265.

V. Fruits. 1. *Anise from Conium.*—Anise has flat face, 5 light brown filiform ridges, also 15 or more thin oil-tubes; conium has 5 crenate ribs but no oil-tubes. See pages 428, 432.

2. *Fennel from Caraway.*—Fennel has 5 obtuse, conspicuous ribs, 4 oil-tubes on back, 2–4 on flat face; caraway has 5 filiform ribs, 6 oil-tubes. See pages 430, 434.

VI. Seeds. *Stramonium from Black Mustard and Colchicum.*—Stramonium has albumin whitish, oily, enclosing cylindrical embryo, curved parallel with edge of seed; mustard has oily embryo, radicle curved, 2 cotyledons, one folded over the other; colchicum has albumin oily, horny, tough, enclosing small embryo opposite hilum, monocotyledonous. See pages 112, 250, 534.

VII. Powders. 1. *Starches.*—Each starch has a characteristic-sized and shaped granule dependent upon its source. As these, therefore, all differ, we have only to take several $\frac{1}{4}$ gr. (.016 Gm.) samples of a specimen and add to each a drop of water on a slide under a cover-glass —with $\frac{1}{5}$-inch objective we can recognize readily the predominating starch and identify all possible starchy adulterations: corn-starch (*official*, pages 82, 84) is mostly in pentagons and hexagons; rice-starch (page 85) similar, but only one-fifth size; wheat-starch (page 84), lenticular layer indistinct, hilum central, third larger than corn-starch; also notice starches of maranta (pages 84, 127), canna (page 127), curcuma (pages 85, 133), sago (pages 85, 95), ginger (page 130), cassava (pages 85, 372). All starches turn blue with iodine and swell with potassium hydroxide solution or diluted sulphuric acid.

2. *Ginger from Corn- and Wheat-starch.*—Ginger contains normally about 20 p. c. of its own peculiar starch, whose granules are flat and broadly ovate, but when seen edgewise look long and narrow, with small hilum near narrow end, marked by many transverse lines. Resemble but are smaller than granules of E. India arrowroot; corn- and wheat-starch added increase the amount beyond 20 p. c., and can be recognized by their characteristic shapes. See pages 84, 130.

3. *Cloves from Powdered Shells and Starch.*—Cloves is very simple, consisting of fragments of parenchyma-cells, having thin walls and a faint yellow color; a few long, stout, colorless bast-fibres and some small spiral vessels; no starch; shells consist of thick-walled stone-cells, lignified, with pore-canals, etc. See pages 84, 416.

4. *Taraxacum from Chicory.*—Taraxacum consists of clear white fragments of parenchyma-cells, with occasional large vessels approach-

ing the scalariform in type; chicory is similar to taraxacum, except that the vessels are slightly smaller and more reticulate. Some latex tubes may also be seen. See pages 593, 596.

5. *Digitalis from Senna.*—Digitalis has numerous multicellular hairs, which, having constrictions, appear to be formed of a number of elongated cells; senna, on the contrary, has many unicellular hairs having thick and rough cell-walls. See pages 283, 538.

6. *Stramonium from Tobacco.*—Stramonium has multicellular hairs somewhat resembling digitalis, while tobacco also has multicellular hairs, some having glands at their free extremities. See pages 534, 537.

7. *Kamala from Lupulin.*—Kamala consists of stellately arranged, colorless hairs mixed with depressed globular glands, containing 40–60 club-shaped vesicles; lupulin consists of minute granules, subglobular or hood-shaped, reticulate, lower half obtusely conical. See pages 161, 375.

8. *Lycopodium from Pine-pollen.*—Lycopodium consists of granules that are tetrahedral, reticulated, rounded on one side and on the edge, with short projections; pine-pollen consists of an elliptic cell, at each end of which is attached a globular cell. See pages 67, 68.

APPENDIX.

POISONS—TREATMENT AND ANTIDOTES.

Poisoning may be of two kinds: 1. Chronic, where small doses are repeated at more or less short intervals, thereby slowly establishing characteristic symptoms (arsenic, bromides, iodides, lead, etc.). A few drugs have been termed "criminal poisons," because when thus given they produce effects partly imitative of certain diseases, hence preclude ready conviction of the guilty (arsenic, colchicum, tartar emetic, etc.). 2. Acute, where a single excessive dose is taken, which quickly produces alarming conditions, and it is this phase of the subject that should be understood as here considered.

Some poisons produce specific symptoms that are recognized and treated easily, others have more complex action that require a general treatment. Nearly all give evidence of gradual ingestion within 15–30 minutes, while a few, being absorbed very quickly, show effect almost immediately (hydrocyanic acid, strychnine, nicotine, reptile-venom, gases, etc.). All demand prompt medication and imply doubtful recovery, consequently, owing to the greatest possible haste being necessary, both physicians and pharmacists should consider it imperative to have always in mind the respective treatment and at command the many combating remedies. These are called: 1, *antidotes* that act either (*a*) mechanically—by simply protecting the stomach walls from the poison (starch, flour, oil, demulcents, etc.), or (*b*) chemically—by combining to form less soluble and active compounds in the stomach (tannin, sodium sulphate, magnesium sulphate, lime water, magnesium oxide, etc.); 2, *antagonists*, that act (*c*) physiologically—by neutralizing or counteracting the action of the drug after it enters circulation (atropine—morphine; aconite—digitalis, etc.).

Rationale of Treatment.

Excessive quantities of poisons frequently from the first cause free vomiting and purging *per se*, thereby largely correcting their evil effects, but when neither of these occurs, vomiting should at once be induced by either zinc sulphate, mustard, pump, apomorphine, etc.; next administer the proper chemical antidote (if one exists), or physiological antagonists (incompatibles), awaiting thereafter 15 minutes; now produce emesis, and wash out stomach with warm or warm-medicated water; finally treat functional and organic symptoms (respiration, circulation, temperature) that may necessarily arise. In depressing poisons, as well as corrosive substances, emetics should be used cautiously, lest by wrenching we occasion greater exhaustion and possibly a rupture of the impaired stomach-wall; here the pump or siphon-tube is to be preferred. The bladder should be emptied frequently, if necessary by catheter, and in many cases a quick-acting cathartic is of considerable advantage. Diffusible (cardiac) stimulants, artificial respiration, electricity, artificial heat, etc., are all at times of great service.

While it is true that the majority of poisons demand specific and different treatment, yet for simplicity sake a few groups can be formed, each containing drugs amenable to like antagonism, thus—alkalies and alkaline salts are combated with weak acids, albumen, demulcents; acids and acid salts with weak alkaline solutions, albumen, demulcents, oil; alkaloidal drugs with tannin, coffee, tea; depressants with stimulants and *vice versa*, etc.

USUAL AGENTS EMPLOYED IN POISON CASES.

1. *Jeaunel's General Antidote.*—Either of the following formulas may be employed when the nature of the poison is doubtful, or for arsenic, digitalis, mercuric salts, opium, strychnine, and zinc salts, but is of no value for antimony compounds, caustic alkalies, or phosphorus:

℞.	Liquor Ferri Tersulphatis,	℥iiss	(75 Ml. (Cc.))
	Magnesii Oxidum,	℥ij	(60 Gm.)
	Carbo Animalis,	℥j	(30 Gm.)
	Aqua Fontana,	℥xx	(600 Ml. (Cc.)). M.

Keep the three last ingredients always mixed, and add liquor when needed. Dose, ℥ij–3 (60–90 Ml. (Cc.)).

℞.	Magnesii Oxidum,	℥ij	(60 Gm.)
	Carbo Ligni,	℥ij	(60 Gm.)
	Ferri Hydroxidum,	℥ij	(60 Gm.)
	Aqua Fontana,	℥xij	(360 Ml. (Cc.)). M.

Dose, *ad libitum.*

2. *Albumen, White of Egg.*—Dissolve 4 egg-whites in a quart of warm water—for mineral acids, mineral salts (corrosive sublimate, etc.), corrosive alkalies, aniline, creosote, bromine, chlorine, iodine, etc.

3. *Milk, Fatty Oils, Mucilaginous Substances.*—Substitutes for albumen—for corrosive salts, corrosive acids and alkalies (especially ammonia), but the first two never for cantharides (phenol—carbolic acid), copper salts, or phosphorus, whose absorption they promote.

4. *Castile Soap.*—Dissolve in 4 volumes of water, as a substitute for albumen—for corrosive acids, metallic salts (corrosive sublimate, potassium dichromate, tin and zinc salts), corrosive vegetable substances; harmful in alkaline poisoning, hence not to be used. Dose, ℥ij–12 (60–360 Ml. (Cc.)).

5. *Tannic Acid, Coffee, Tea.*—To precipitate the various alkaloids as insoluble tannates; *Potassium Permanganate*—for morphine, codeine, etc.; *Dialyzed Iron*—for arsenic; *French (Old) Oil of Turpentine*—as physiological antidote for phosphorus; *Ammonia Water, Aromatic Spirit of Ammonia, Brandy, Whisky, Amyl Nitrite, Faradic Battery, etc.*—for general stimulation.

6. *Vinegar, Diluted Mineral Acids.*—To neutralize alkalies and alka-

line salts; *Magnesium Oxide, Sodium Bicarbonate, Calcium Carbonate, Sodium and Magnesium Sulphates*—for various acids and acid salts; *Charcoal*, animal and vegetable—for arsenic, corrosive sublimate, etc.; *Hydrated Chloral, Chloroform, Ether, Potassium Bromide*—as narcotics or anæsthetics in tetanic poisoning.

7. *Emetics:* (1) Zinc Sulphate, gr. 5–15 (.3–1 Gm.), repeated twice if necessary, at 15-minute intervals, or until emesis is produced; (2) Mustard, ʒj–4 (4–15 Gm.), stirred to a cream with water; (3) Ipecac, gr. 15 (1 Gm.), repeated if necessary in 15 minutes; Apomorphine Hydrochloride, 2 p. c. solution, ♏iij–5 (.2–.3 Ml. (Cc.) hypodermically); Stomach-pump, or Rubber Tubing (5–8 feet of $\frac{1}{2}$ inch); Tartar Emetic, gr. $\frac{1}{2}$ (.03 Gm.) in sweetened water, for children.

8. *Hypodermic Solutions:* (1) Atrophine Sulphate, 1 p. c., ♏ij–6 (.13–.4)—as physiological antidote for aconite, benzene, gelsemium, morphine, muscarine, opium, physostigmine, pilocarpine, etc.; (2) Pilocarpine Nitrate, 5 p. c., ♏x–15 (.6–1 Ml. (Cc.))—as physiological antidote for atropine, scopolamine, daturine, duboisine, hyoscyamine, etc.; (3) Morphine Sulphate, 10 p. c., ♏v–8 (.3–.5 Ml. (Cc.))—for similar use as pilocarpine nitrate; (4) Strychnine Sulphate or Nitrate, 2 p. c., ♏ij–3 (.13–.2 Ml. (Cc.))—as physiological antidote for most depressants: acetanilid, aconite, hydrated chloral, chloroform, conium, physostigma. All of these should be used in an aseptic hypodermic syringe.

In cases of specific poisoning the following treatments are recommended:

Acetanilid, Antifebrin, Antipyrine, Phenacetin: Empty stomach, place in recumbent position, supply abundant fresh air or oxygen (for cyanosis, loosen clothing around neck, chest, and waist), stimulants (brandy, whisky, ammonia), external heat, atropine or belladonna (to maintain blood-pressure), strychnine to aid respiration.

Acids: If these have been taken in concentrated form, it is unwise to give emetics or use the pump, as either might tend to lacerate the softened œsophagus.

1. *Chromic, Potassium Chromate and Dichromate:* Emetics, then magnesium oxide or carbonate, sodium bicarbonate or borate, chalk in water to a paste, demulcent drinks (flaxseed, elm, etc.), stimulant enemas.

2. *Hydrocyanic—Cyanides, Oil of Bitter Almond, Cherry Laurel Water:* Recumbent position, abundant fresh air, oxygen, smell chlorine water or diluted chlorine gas, vomit, hypodermic atropine for heart, brandy, ether, ammonia inhalations; if breathing ceases, use artificial respiration, mild faradic current to the heart, alternate cold and warm affusions to head, chest, and spine; ferrous and ferric sulphates followed by potassium carbonate solution yield insoluble Prussian blue (antidote), ferrous sulphate alone or with magnesium oxide renders acid insoluble, but the action of the acid is so quick that, as a rule, antidotes avail little; ♏xv (1 Ml. (Cc.)) of official acid, or gr. 1 (.06 Gm.) of anhydrous acid, usually is fatal in 15 minutes.

3. *Mineral—Hydrochloric, Nitric, Nitrohydrochloric, Sulphuric, Phos-*

phoric, Glacial Acetic: Neutralize with an alkaline solution—sodium, potassium, magnesium carbonate or bicarbonate, magnesium oxide, lime, chalk or wall-plaster (H_2SO_4), dissolved or mixed with water, soap-suds, water freely, except with sulphuric, then demulcent, drinks gruel, egg-white, almond or olive-oil, warmth and friction to extremities (feet, hands), emollient fomentations, brandy and whisky for collapse, morphine for pain.

4. *Oxalic—Oxalates, Salt of Lemon (Potassium Oxalate):* Unless the poison has occasioned vomiting, empty stomach at once, then neutralize with chalk, whiting or wall-plaster in creamy paste with water, lime water, now vomit to get rid of insoluble calcium oxalate, give demulcent drinks, oils, opium for pain, hot fomentations to abdomen, friction to extremities (feet, hands), enema, much water to hasten elimination by kidneys ; avoid potassium and sodium (alkaline) carbonates, as they form soluble oxalates ; ℥ss–1 (15–30 Gm.) usually proves fatal.

Aconite, Aconitine, Pulsatilla: Evacuate and wash out well the stomach, unless symptoms severe, when vomiting should be avoided, if possible, and then in a towel without raising head ; place in recumbent position, with absolute quietness, feet elevated (to confine circulation to vital centres at base of brain), dry warmth to body, especially extremities (feet, hands), cardiac (diffusible) stimulants (brandy, whisky, alcohol, ether, ammonia) by mouth or skin, digitalis for heart syncope (tincture ♏xxx; 2 Ml. (Cc.)), hypodermic atropine (♏iv; .26 Ml. (Cc.)) or strychnine (gr. $\frac{1}{20}$–$\frac{1}{10}$; .003–.006 Gm.) for cardiac and respiratory stimulation, tannin, amyl nitrite, oxygen, artificial respiration. Tincture of aconite ♏xxx–60 (2–4 Ml. (Cc.)), and aconitine gr. $\frac{1}{20}$ (.003 Gm.), have each proved fatal.

Alcohol, Alcoholism, Delirium Tremens: Drunkenness resembles somewhat opium-poisoning and brain concussion. Empty stomach, washing it out well with strong warm coffee, apply warmth to body and extremities (feet, hands), cold douche to head, plenty fresh air, interrupted current to respiratory muscles, inhale ammonia, amyl nitrite, artificial respiration, keep awake mechanically.

Alkalies, Potassium and Sodium Hydroxide, Ammonia, Spirit of Hartshorn, Ammonia Smelling-salts, Carbonates: Neutralize with vinegar, lemon-juice, diluted acetic acid, then give demulcent drinks, fatty oils, opium to relieve pain. For ammonia gas inhale warm acetic acid vapor, and lessen chest-pain by a few chloroform inhalations.

Alkaloids: Empty stomach at once, follow with tannin solution or strong coffee, tea to form insoluble tannates.

Alum: This usually vomits *per se*, otherwise give emetic, then ammonium or potassium carbonate, demulcents.

Aniline (Dyes, Ink): Vomit with copper sulphate, or wash out well the stomach with warm water, place in recumbent position, loosen clothing, abundant fresh air, oxygen, ether injections, ammonia, whisky, brandy, strychnine, magnesium oxide (gr. 30 ; 2 Gm.) ; ʒss–2 (2–8 Gm.) have proved fatal.

Antimony, Chloride, Wine, Tartar Emetic: These usually vomit actively *per se;* if not should empty stomach, giving abundance of warm water, follow with tannin solution, coffee, tea, gallic acid (to form insoluble tannates), demulcent drinks, egg-white, milk, warmth, friction, faradic current over heart, opium and stimulants in small and frequent doses, artificial respiration; magnesium and sodium carbonates may be used, also ferric hydroxide followed with opium or morphine for pain; magnesium oxide in milk for the chloride; Tartar Emetic, gr. 2–5 (.13–.3 Gm.) have killed, much larger doses often have failed.

Arsenic, Paris Green, Fly-stone or -powder, Fowler's Solution, Rough on Rats, Cobalt: Produce emesis if it has not occurred, washing out the stomach with much water, then give freshly precipitated ferric hydroxide, made by double decomposition between any ferric solution well diluted, and either ammonia water well diluted, sodium carbonate, or magnesium oxide, the object being to envelop the poison mechanically and to form insoluble ferric arsenite or arsenate; usually give ʒj (4 Gm.), every 5 minutes, for 8 doses, and follow with zinc sulphate, then castor oil; may give oils, demulcent drinks, egg-white, and stimulants for faintness and great depression, warmth to body, opium or morphine for pain, poultices and fomentations to stomach, flour, lime water, dialyzed iron, subcarbonate of iron, alkaline mineral waters.

Belladonna, Scopola, Hyoscyamus, Stramonium, Duboisia, Dulcamara (Atropine, Scopolamine, Hyoscyamine, Daturine, Duboisine, Solanine): Empty stomach, give tannin solution, strong coffee, tea by mouth or rectum, hypodermic morphine, physostigmine or pilocarpine (to antagonize nervous disturbance, delirium, etc.), then diffusible stimulants (whisky, brandy, ammonia), caffeine, strychnine, cold to head, warmth and friction to extremities (feet, hands), artificial respiration.

Benzene, Nitrobenzene, Oil of Mirbane: Empty stomach, give plenty fresh air, hypodermic atropine, alternate cold and hot water douches to chest, mild faradic current over heart, artificial respiration.

Bites. 1. *Dogs, Cats:* At once suck forcibly the wound, endeavoring also by squeezing to force out all blood possible, wash with warm water, and cauterize well with lunar caustic; 2. *Snakes:* Apply cupping-glass over wound, or tie the limb moderately tight above injured spot, allow to bleed freely, aiding by pressure, wash with warm water and cleanse thoroughly, cauterize with mineral acids or phenol (carbolic acid); apply potassium permanganate solution (5–10 p. c.), ammonia water, tincture of iodine; cause perspiration by warm drinks, ammonia, wine, arsenic; one with perfect mucous surface should forcibly suck wound; if much prostration, give liberally of diffusible stimulants (whisky, brandy, ammonia); bleed at one arm, transfuse blood or "normal salt solution" by the other; 3. *Insects, Bees, Wasps, Hornets:* Apply locally ammonia water or some alkaline solution, may saturate cloth with ammonia water or sodium chloride solution and lay over part until pain dispelled; remove sting by pressing a watch-key over it. give stimulants (ammonia, wine, etc.), may apply onion to wound, but not of much value.

Bromal Hydrate: Large doses kill in a few minutes, with contracted pupil, dyspnœa, and convulsions, death from failure of respiration; acts on heart muscle direct, much more powerful than hydrated chloral. Inhale abundant fresh air, ammonia, empty stomach, cardiac stimulants (strong coffee, alcohol, caffeine, digitalis), cold to head, warmth to extremities, strychnine, electricity, amyl nitrite, artificial respiration, quietness.

Bromine, Bromides: For bromine, if swallowed, give well-diluted ammonia water, olive or almond oil; if inhaled, then breathe ammonia vapor and abundant fresh air, for bronchial irritation inhale a little chloroform. For bromides give cardiac stimulants (strong coffee, caffeine citrate, digitalis), morphine is the best antagonist for mental symptoms, may give strychnine, ergot, belladonna, cathartics, diuretics.

Camphor: Empty stomach, give alcohol or brandy in small and frequent doses (best hypodermically), coffee, ether inhalations, alternate hot and cold douche, warmth to extremities by hot blankets, etc., opium and bromides for convulsions.

Cannabis: Somewhat similar to opium and hydrated chloral. Emetics, lemon juice to neutralize, tannin, hot coffee, hypodermic atropine (gr. $\frac{1}{120}$; .00054 Gm., every 15 minutes for 3 doses), ammonia, strychnine, electricity to chest muscles, artificial respiration, keep awake, also body warm, empty bladder often.

Cantharides, Cantharidin: Empty stomach, give demulcent drinks freely (barley, elm, flaxseed tea, diluted egg-white, gruel or pure water), hypodermic morphine or tincture of opium (by mouth or rectum) to allay pain and gastro-enteritis; avoid oils and oily emulsions, as these favor solubility and absorption of cantharidin, stimulants, warmth to extremities, warmth and cataplasms to abdomen; powdered drug ʒss (2 Gm.) or tincture ℥j (30 Ml. (Cc.)) usually proves fatal.

Carbon Disulphide: Vomit, give potassium bromide and hydrated chloral (for nervous excitement), stimulants (to support circulation), inhale ammonia, warmth to body, cold douche to head, artificial respiration.

Castor Beans: Vomit at once, give demulcent drinks, opium for pain and to quiet violent symptoms, which resemble those of cholera; 3 seeds, also 20, have each killed in 2 and 5 days.

Chloroform, Ether, Nitrous Oxide Gas: Withdraw at once the source, lower well the head, pull tongue forward, to admit fresh air, compress and relax chest, ammonia and amyl nitrite inhalations, warmth and friction to extremities, hot and cold douche, weak current—one pole on the larynx, other on the pit of stomach; if heart stopped, give several taps over that region, inhale, ammonia, brandy, atropine, strychnine, artificial respiration. If swallowed, treat as hydrated chloral; vomit, enema of hot coffee, draughts of water containing sodium carbonate or bicarbonate, ammonia, warmth; chloroform inhalation kills 1 in every 3,000; ether, 1 in every 16,000; nitrous oxide gas, 1 in every 300,000.

Chlorates, Nitrates (Potassium, Sodium, etc.): Vomit, plenty of water and demulcent drinks for dilution, amyl nitrite, opium for pain, hot fomentations to loins; avoid stimulants (increase kidney congestion); ʒviij–12 (30–45 Gm.) usually prove fatal in a few hours.

Chlorine Water, etc.: Give emetic, warm water, then milk, egg-white (albumin), flour with water or lime water, ammonia water.

Cocaine, Eucaine: Similar to belladonna, etc., as they closely resemble atropine in action on pulse, pupils, respiration, sweat-glands, and bowels. Empty stomach, give tannin, morphine (best antidote), then in sequence hydrated chloral, chloroform, ether, alcohol, amyl nitrite to stimulate heart, strychnine, artificial respiration, caffeine, ammonia inhalations.

Colchicum (Wine, Tincture, Extract, Fluidextract, etc.): Unless vomiting and purging already have occurred, induce at once the former, give tannin (gr. 30; 2 Gm.), gallic acid, strong coffee or tea, abundant water, demulcent drinks, morphine or opium to allay pain, purging, and heart depression, cardiac (diffusible) stimulants, hot fomentations to abdomen, keep extremities (feet, hands) warm; powdered root gr. 50 (3.3 Gm.), seeds ʒiv (15 Gm.), root wine ʒiv (15 Ml. (Cc.)), have each proved fatal.

Conium, Coniine: Emetics or lavage, tannin, strong coffee, tea, again wash out stomach, external warmth (hot wraps, bags, bottles, etc.), epispastics, alcohol, stimulants, strychnine, picrotoxin, hypodermic atropine, artificial respiration, castor oil; coniine ♏j–2 (.06–.13 Ml. (Cc.)) usually fatal in 1–3 hours.

Colocynth, Elaterium, Elaterin: Empty stomach, give demulcent drinks, enemas, opium for pain (small doses,) warm bath, stimulants (brandy, whisky, etc.).

Croton Oil: Empty stomach, give hypodermic morphine or laudanum every 20 minutes until pain and purging abated, demulcent drinks, mucilage, milk, egg-white, olive oil, soup, spirit of camphor, stimulants, warmth and friction; ʒss–2 (2–8 Ml. (Cc.)) have killed in 4–6 hours.

Curarine, Woorare, Urare: If wounded, ligate above injury, suck forcibly, and wash well with alkaline solution (potassium permanganate), warmth to loins, abundant water, spirit of nitrous ether (to aid urine elimination), artificial respiration, empty bladder often; resembles digitalis much more than it does strychnine.

Digitalis, Convallaria, Scoparius, Strophanthus, Apocynin, Scillain, Scillitin: Vomit or wash out the stomach well with warm water and tannin, strong coffee, tea; keep reclined, never allowing erect position, as that may cause fatal syncope; aconitine (gr. $\frac{1}{200}$; .0003 Gm.), or tincture of aconite (♏v; .3 Ml. (Cc.)) best for large quantities, opium best following prolonged usage, saponin and senegin best physiological antagonist, diffusible stimulants by mouth or rectum, warmth and friction to extremities (feet, hands); powdered drug ʒss (2 Gm.), tincture ʒij–4 (8–15 Ml. (Cc.)), have proved fatal.

Ergot: Empty stomach, give plenty warm drinks, tannin, coffee, tea, quick purgative (croton oil ♏j; .06 Ml. (Cc.)), recumbent position, small doses of opium at intervals for pain and irritation, nitroglycerin occasionally (gr. $\frac{1}{50}$; .0013 Gm.), hot baths, warmth, friction to maintain circulation), stimulants, amyl nitrite.

Gamboge, Scammony: If vomiting and purging have not occurred, induce former by usual emetics, may give solution of potassium or sodium carbonate, magnesium oxide in milk, demulcent drinks, and enemas, opium in small doses to allay pain and purging.

Gelsemium, Gelsemine: Emetic or wash out stomach with tannin solution, then hypodermic atropine and morphine, warmth and friction, cardiac stimulants (digitalis, alcohol, coffee, ammonia), artificial respiration, electricity, rouse patient by cold and hot douche; fluidextract ʒj (4 Ml. (Cc.)), or tincture ℥iv (15 Ml. (Cc.)), are usually fatal.

Gases: 1. *Chlorine:* Inhale cautiously ammonia or hydrogen sulphide, steam often valuable for breathing, abundant fresh air, egg-white, milk, flour, lime water, demulcent drinks, chloroform or ether inhalations for cough; 2. *Hydrogen Sulphide:* Chlorine gas well diluted with air cautiously inhaled, fresh air; 3. *Illuminating-gas, Carbon Dioxide, Carbon Monoxide:* Remove clothing, open doors and windows, abundant air, oxygen, horizontal position, alternate cold and warm douche to chest and head, ammonia inhalations, diluted chlorine gas carefully breathed, faradic current to extremities, alcohol by mouth or rectum, strong coffee by enema, artificial respiration, venesection, warmth to body and limbs, place in bed, direct quietness, circulating air, cold acid drinks freely.

Glass—coarse or powdered: Large quantity of bread-crumbs as an envelope, then emetics.

Hydrated Chloral: Empty stomach, give coffee by mouth or rectum (using tube if necessary), abundant fresh air, friction, cataplasms to limbs and over heart, hypodermic strychnine or picrotoxin every 15 minutes, keep awake by coffee, caffeine, flagellation, shaking, shouting, ammonia to nostrils, cold to head; if serious, place in recumbent position, absolute rest, amyl nitrite inhalations (to stimulate heart), artificial respiration; ʒss–1 (2–4 Gm.) has killed.

Hyoscine: Similar to belladonna, but hydrated chloral is used here with great advantage.

Iodine: Give starch in hot water, or flour in warm water, farinaceous substances (rice, arrowroot, gruel, etc.), then vomit, demulcent drinks, egg-white in milk, sodium bicarbonate, stimulants (alcohol, digitalis, amyl nitrite), atropine, strychnine, opium or morphine for pain.

Ipecac: Unless thoroughly vomited, empty stomach, washing it out with tannin solution, if necessary follow with opium, belladonna, cardiac (diffusible) stimulants.

Iodoform, Iodol, Aristol: Give potassium bromide, to dissolve iodine compound, lemonade, potassium acetate solution, stimulants, diaphoretics, warm sponge bath, small repeated doses of tincture of opium, large doses of potassium bicarbonate, diluents freely.

Lead and Barium Salts: Give magnesium or sodium sulphate (℥ss; 15 Gm.) in a glass of water to form insoluble sulphate, then vomit, follow with purgative enema, demulcent drinks, milk, egg-white, diffusible stimulants, opium for pain; for lead colic apply hot-water bag, hot fomentations; for chronic lead-poisoning, recognized by blue line (sulphide) along margin of gums, drop-wrist (extensors paralyzed), constipation, etc., give iodides to saturation (sodium and calcium being best), sulphur or sulphurated potassa baths, sulphuric acid, friction to muscles, calomel, lemonade, strychnine, faradic current.

Lobelia: If patient has failed to vomit, use emetic, follow with tannin, cardiac and respiratory stimulants, strychnine or picrotoxin hypodermically, opium, thebaine, alcohol, digitalis, atropine, ergot; caustic alkalies decompose lobeline, also preparations; ʒj (4 Gm.) has killed.

Mercury and Copper Salts (*Corrosive Sublimate, Nitrate, White Precipitate, etc.*): Give egg-white, beaten up with water (1 egg for every 4 grains (.26 Gm.) of corrosive sublimate), follow with emetic at once, to avoid re-solution, after this demulcent drinks, stimulants, warmth, friction, opium or morphine for pain; in the absence of egg-white, use flour-paste, or milk, or meat-broth; for copper salts may give additionally reduced iron, weak solution of potassium ferrocyanide, then potassium iodide until system saturated to promote elimination; tannin, strong coffee, tea useful in combating these metallic salts; for salivation, use bismuth, sodium sulphite, weak nitric or sulphurous acid, belladonna to diminish ptyalism; corrosive sublimate gr. 3–5 (.2–.3 Gm.) are usually fatal in ½–2 days; copper sulphate and acetate, ʒviij (30 Gm.) and ʒiv (15 Gm.), respectively, have killed in 4–12 hours.

Mezereum: Evacuate stomach with warm albuminous or mucilaginous drinks, then milk, fatty oils, demulcent enemas, opium for depression, cold poultices to abdomen.

Mushrooms, Poisonous Fungi, Muscarine: Empty stomach, give hypodermic atropine or tincture of belladonna, tannin, castor oil and enema to remove fungi from lower bowel, alcoholic stimulants, warmth, friction, poultice to abdomen.

Nitroglycerin, Amyl Nitrite: Give atropine, strychnine, picrotoxin, digitalis to increase functional activity of spinal cord and sympathetic system, stimulants, artificial respiration, alternate cold and hot douche to head, ergotin.

Opium, Lactucarium, Morphine, Codeine, Laudanum, etc.: If taken by mouth, give at once ½ p. c. solution of potassium permanganate (℥viij; 240 Ml. (Cc.)), then empty stomach by pump, apomorphine, etc., washing it out well with strong hot coffee, leaving therein at least a pint (.5 L.), tannin solution, keep body warm but alternate hot and cold douche to the head, hypodermic atropine and strychnine as respiratory stimulants (every 15 minutes for 3 doses), electricity to chest muscles, artificial respiration, digitalis as heart stimulant, ammonia inhalations, amyl nitrite, keep awake by shaking, flicking with a towel, cold water over face and chest, walking between attendants; evacuate bladder often to prevent reabsorption. If poison taken hypodermically, proceed as outlined, omitting chemical antidote and vomiting; opium gr. 5 (.3 Gm.), or morphine gr. 1 (.06 Gm.), usually prove fatal in 5–12 hours.

Phenol (*Carbolic Acid*), *Creosote*, *Resorcinol:* The pneumogastric filaments, in mucous membrane of the stomach, are usually so obtunded as not to respond to emetics, so if considered safe, empty stomach with pump or hypodermic of apomorphine, or give as soon as possible alcohol ℥iv (120 Ml. (Cc.)) mixed with equal quantity of water, remove at once by emetic or tube, repeat this every 5–10 minutes for 4 to 8 times; alcohol stimulates and protects stomach from corrosive action of poison, may employ diluted acetic acid for alcohol; or may wash out the stomach with 10 p. c. solution sodium bicarbonate (℥viij; 240 Ml. (Cc.)), following with antidote—magnesium or sodium sulphate (℥ij; 60 Gm.), in weak solution, to form harmless sulphophenolate, then demulcent drinks, egg-white (to protect mucous surfaces), but no oils or glycerin; stimulate with whisky, brandy, alcohol, ammonia, and if necessary digitalis, strychnine, warmth and friction to extremities (feet, hands), counter-irritants to abdomen, opium for pain, atropine. To local abrasions apply sodium carbonate solution, using same for mouth-wash; the brownish or blackish urine and eschars serve to identify this poison.

Phosphorus, Rat Paste, Matches: Empty stomach, preferably with copper sulphate (gr. 3; .2 Gm., repeated 2–4 times at 5-minute intervals) to form insoluble black phosphide, follow every half-hour with old viscid (oxygenated, acid, French) oil of turpentine (ʒj; 4 Ml. (Cc.)), floated on water, follow with magnesium sulphate (℥j–3; 30–90 Gm.) in a glass of water as a cathartic; may give hydrated magnesia, lime water, charcoal. If the phosphorus be taken in solution, give potassium permanganate to cause oxidation, opium for pain; albumin, egg-white valuable, but never fats or fatty oils, as these are solvents, hence aid its absorption; empty bladder often; phosphorus gr. 1 (.06 Gm.) is usually fatal in 1–5 days.

Physostigma, Physostigmine, (*Eserine*): Evacuate stomach, give tannin, coffee, tea, hypodermic atropine every 15 minutes until pupils dilated and pulse strong; if this should fail, give hydrated chloral (gr. 10; .6 Gm.) at same intervals, or hypodermic strychnine, then cardiac stimulants (alcohol, coffee, digitalis, ammonia), artificial heat and respiration, electricity; empty bladder often; 6 seeds have killed.

Phytolacca: Similar to aconite and veratrum, but unlike the latter in that vomiting ensues much more slowly; within 2 hours usually acts *per se* as an emeto-cathartic, after which give cardiac stimulants (alcohol, ammonia, ether, digitalis, etc.), opium for pain.

Pilocarpus, Pilocarpine: Similar to physostigma; evacuate stomach, washing it out well with tannin solution, follow with hypodermic atropine (gr. $\frac{1}{60}$; .001 Gm.), or tincture of belladonna (♏xx; 1.3 Ml. (Cc.)), every 20 minutes until pupils dilated; morphine to control nausea and vomiting, cardiac (diffusible) stimulants.

Ptomaines: Toxic alkaloids in meat, sausage, pork, fish, lobster (canned or otherwise), poisoned game, putrescent food, cheese, etc.): Empty stomach at once, using large draughts of warm water, tannin, coffee, tea; castor oil as a purgative, after this operates give diluted vinegar, sponging the body with some weak alkaline solution, alcoholic stimulants for depression, warmth to abdomen, friction to extremities, opium for spasms.

Savin, Sabina Oil and Tops, Tansy and Oil: If not already vomited give at once an emetic, move bowels freely with Epsom salt, castor oil (full dose), stimulants, allay pain with morphine and demulcents, flaxseed meal poultice to stomach.

Poison Ivy (Oak): Apply at once locally soap and water with scrubbing-brush, then lead water, alkaline solutions (sodium bicarbonate, sulphite, chlorinated, diluted ammonia, soapsuds, alum curd), tincture or infusion of lobelia, grindelia, sassafras, impatiens biflora, cocaine solution, aristol, opium; internally cooling drinks, low diet, saline purgatives, quietness.

Quinine, etc.: Give potassium bromide, hydrobromic acid, cardiac and respiratory stimulants; morphine counteracts cerebral action, atropine the nervous, cardiac, and antipyretic effects.

Silver Salts, Nitrate, Lunar Caustic: Give sodium chloride (table salt) ʒiv (15 Gm.), dissolved in a glass of warm water to form insoluble silver chloride, or use egg-white, or milk, follow with emetic and large draughts of warm water, demulcent drinks; may use alkalies, alkaline carbonates, lime water, tannin. Following prolonged usage, give purgatives, diuretics, potassium iodide, sodium hyposulphite baths.

Staphisagria, Stavesacre: Similar to aconite and veratrum; evacuate stomach, then tannin, charcoal, diffusible stimulants, keep quiet, recumbent, feet elevated, extremities warm; chloroform inhalations for spasms, or hydrated chloral (gr. 30; 2 Gm.), or potassium bromide (ʒj–2; 4–8 Gm.); use all haste, as death is by asphyxia.

Strychnine, Brucine, Nux Vomica, Ignatia, Picrotoxin, Cocculus Indicus, Hydrastis: Remove patient from all noise, quickly evacuate stomach, give tannin (gr. 30; 2 Gm.) dissolved in water, or iodide of starch to form insoluble strychnine perhydroiodide, charcoal; control spasms by inhaling chloroform or ether, or by large doses of hydrated chloral and potassium bromide in solution by mouth or rectum, thus keeping up mild narcosis for several hours if necessary; spasms may stop respiration, hence control these at all risk, amyl nitrite, artificial respiration, soluble iodides, tobacco, opium, physostigmine, atropine, conium, Indian hemp; empty bladder often; nux vomica gr. 30 (2 Gm.), or extract gr. 3 (.2 Gm.), or strychnine gr. $\frac{1}{2}$–1 (.03–.06 Gm.), is each usually fatal in $\frac{1}{4}$–3 hours.

Tobacco, Nicotine: Induce vomiting if not already accomplished, give quietness, recumbent position, tannin, strong coffee, tea, then an emetic, hypodermic strychnine (physiological antidote) or tincture of nux vomica by mouth, diffusible stimulants alcohol, brandy, whisky, ether, etc.), warmth to body, ergot, digitalis, belladonna, iodides, artificial respiration, cold douche to head; nicotine ♏xv–60 (1–4 Ml. (Cc.)) are fatal in 1–3 hours.

Tin Salts: Empty stomach, then milk of magnesia, demulcent drinks, opium for pain.

Turpentine: Emetics, if no purging give enema, then plenty of water and demulcent drinks, hot fomentations to loins, opium to allay pain.

Zinc Salts, Sulphate, Chloride, Burnett's and Platt's Solutions: Should vomiting not have occurred, give plenty warm water containing sodium carbonate or bicarbonate to form insoluble zinc carbonate, or mustard (ʒij; 8 Gm.), then egg-white and milk, tannin solution, strong coffee, tea, to form insoluble tannate, opium, morphine, hot fomentations to allay abdominal pain; sulphate ʒxij (45 Gm.) are usually fatal.

Veratrum Viride, Veratrum Album, Veratrine, Sabadilla: Evacuate stomach, unless veratroidine constituent has thus acted, recumbent position, feet elevated, dry warmth to body (wraps, blankets, bottles, etc.), tannin, strong hot coffee, tea, cardiac (diffusible) stimulants (alcohol, brandy, ammonia, etc.), atropine to antagonize cardiac depression, strychnine as respiratory and nervous stimulant, morphine, electricity, artificial respiration.

PRESCRIPTION-WRITING OF THE PHYSICIAN.

Prescriptions (L. *præscriptio*, a writing before, an order; fr. *præscrib(o)-ere*, to write before, to ordain) are *ex tempore formulæ* written in Latin, usually at the bedside, to combat specific conditions, and in their construction certain rules, forms, and requisites must be observed:

1. *Chirography.*—Learn to write legibly, letting your style be plain, neat, thoroughly intelligent without possible ambiguity or doubt for the compounder as to what is intended. Make this your first imperative duty, and if, when a student, your penmanship is indifferent, then at once begin the trial for improvement; this can and will alone come by careful practice, so make sure that you know how to write before knowing what to write.

2. *Prescription Blanks.*—Do not be careless as to the kind and style of paper used, It is well to have uniformity in blanks, and whenever your regular supply becomes exhausted, if possible, replenish at once, using in the interim good, white, unruled paper cut to a specific size. A neglect of this might occasion discourteous remarks somewhere along the line (by attendant, compounder, etc.), which should and can easily be avoided. Blanks are, as a rule, furnished gratuitously by the druggists (who are only too well pleased to have the number great), and in size should be neither too large nor too small, but in keeping with the boldness of individual handwriting. On the other hand, when the style and printing of those supplied are not satisfactory, then others more to one's liking should be secured from the printer at your own expense.

3. *Weights and Measures.*—Of these we may employ three systems:

1. Avoirdupois (Imperial). This has the following subdivisions: grain (gr.), drachm (drm.), ounce (oz.), pound (lb.), and is thus proportioned: 27.35 grains make 1 drachm, 16 drachms make 1 ounce (437½ grs.), 16 ounces make 1 pound (7,000 grs.), 27.35—437½—7,000. By this system all substances are sold except precious stones,

precious metals, and drugs when prescribed by a physician directly or indirectly for sickness.

2. Apothecaries' (Troy). This has the following subdivisions: grain (gr.), scruple (℈), drachm (ʒ), ounce (℥), pound (lb.), and is thus proportioned: 20 grains make 1 scruple, 3 scruples make 1 drachm, 8 drachms make 1 ounce, 12 ounces make 1 pound, 20—60—480—5,760. The difference between the two pounds mentioned is 1,240 grains, the two ounces 42 grains, the two drachms 32.65 grains. The grain, however, is the same the world over, and is the *unit of weight.*

United States Fluid, Liquid, or Wine Measure. This has the following subdivisions: minim (♏), fluidrachm (fʒ), fluidounce (f℥), pint (O), gallon (Cong.), and is thus proportioned: 60 minims make 1 fluidrachm, 8 fluidrachms make 1 fluidounce, 16 fluidounces make 1 pint (2 pints make 1 quart), 8 pints (4 quarts) make 1 gallon, 60—480—7,680—61,440 (58,340 grs.). The minim is the *unit of capacity,* and weighs 0.95 of a grain, the ounce weighing 455.7 grains.

Imperial Liquid Measure (Gt. Britain). This has the following subdivisions: minim (min.), drachm (fl. dr.), ounce (fl. oz.), pint (O), gallon (C). and is thus proportioned: 60 minims make 1 drachm, 8 drachms make 1 ounce, 20 ounces make 1 pint, 8 pints make 1 gallon, 60—480—9,600—76,800 (70,000 grs., or 10 lbs. Avd.). This minim weighs 0.91 of a grain, the ounce weighs 437.5 grains. It is thus seen that we have two minims (0.95—0.91 grain) and three ounces (437.5—455.7—480 grains).

3. Metric, Decimal, or French. This system is based upon the earth's polar circumference (24,818 miles), of which the one-forty-millionth part, 39.37 inches, is taken as the *unit of length* (metre); of the metre one-tenth, 3.93 inches, is taken, and upon it a cube constructed, which contains of distilled water 1,000 Ml. (Cc.) or Gm., and this furnishes the *unit of capacity* (litre); again, of the metre the one-hundredth part, .393 of an inch, is taken, and upon it a cube constructed, which contains of distilled water 1 Ml. (Cc.), weighing 15.434 grains, and this furnishes the *unit of weight* (gramme).

Milli-metre,	mm.,	-litre,	ml.,	-gramme,	mg.	=	.001
		(Cubic centimetre, Cc.)					
Centi-metre,	cm.,	-litre,	cl.,	-gramme,	cg.	=	.01
Deci-metre,	dm.,	-litre,	dl.,	-gramme,	dg.	=	.1
METRE,	M.,	LITRE,	L.,	GRAMME,	Gm.	=	1.
Deka-metre,	Dm.,	-litre,	Dl.,	-gramme,	Dg.	=	10.
Hecto-metre,	Hm.,	-litre,	Hl.,	-gramme,	Hg.	=	100.
Kilo-metre,	Km.,	-litre,	Kl.,	-gramme,	Kg.	=	1,000.
Myria-metre,	Mm.,	-litre,	Ml.,	-gramme,	Mg.	=	10,000.

Here every unit is multiplied or divided by 10, consequently each preceding denomination is just 10 times smaller than the one that follows, thus it takes 10 millimetres to make 1 centimetre, 10 centimetres to make 1 decimetre, etc.

4. *Prescription.*—This consists of four parts: 1. Superscription (date, name and address of patient; also regular sign, ℞, fr. L. *recipio, recipere,* to take; *recipe,* take thou); 2. Inscription (the body, consisting of

basis or chief ingredient, *adjuvant* or assistant to basis, *corrective* or anything to correct the injurious quality of the two preceding, *vehicle* or *excipient* to make it pleasant and of suitable form ; 3. Subscription (directions to the compounder, usually in Latin) ; 4. Signature (directions for taking, also physician's name, in English).

A prescription may consist of a single article, the base, and although the fewer the drugs combined often the better, yet sometimes much good results from mixing several, as in the case of cathartics, of which different ones act upon various portions of the canal. Every article should be written in the Latin genitive, and if of several parts each should receive this ending. It is, however, very seldom that the physician adheres absolutely to this rule, as he so often omits terminations and otherwise abbreviates, a habit that frequently gives ambiguity and sometimes annoyance to the compounder.

Words having nominative ending in *a*, have genitive in *æ ;* those in *us, um, os, on = i ; as = atis ; is = idis, eris, itis ; o = onis, inis,* etc. The quantities are governed by the verb *recipio,* hence are in the objective case, and when expressed in Latin nomenclature, which is very rare, should be placed in the accusative. The English of the average prescription has about this form : Take thou (imp.) of drugs (gen.) certain quantities (acc.), mix thou (imp.), let (thou) a solution, mixture, pills, etc. (nom. s. or pl.), be made (sub. used as passive imp.).

Superscription.		℞	For Mr. Bonaparte, 1241 St. Paul St., Dec. 15, 1916.	
Inscription.	(Basis.)	Morphinæ Sulphatis,	gr. iv	0.26 Gm.
	(Adjuvant.)	Sodii Bromidi	ʒij	8. Gm.
	(Corrective.)	Syrupi Aurantii,	℥j	30. Ml. (Cc.)
	(Vehicle.)	Aquæ Cinnamomi, q. s. (ad)	℥iv	120. Ml. (Cc.)
Subscription.		M., ft. mist. (sol.).		
Signature.	S. (Sig.)	Teaspoonful every 3 hours.		
			Dr. Mitchell.	

5. *Abbreviations.*—Only such as are in common use, along with accustomed signs should be employed, as : ℈, ʒ, ℥, ♏, M, O, S, āā, ad, gr., gtt., ft., lb., et, ss, q. s., sig., cong., misce, mist., cap., chart., emul., pil., solv., sol., pulv., etc. The following should always be avoided : aconit. (for aconitine, aconitum), ammon. (ammonia, ammoniacum), aq. chlor. (aqua chlori, aqua chloroformi), chlor. (chlorine, chloral, chloroform), hyd. chlor. (calomel, corrosive sublimate, hydrated chloral), sod. sulph. (sodium sulphite, sulphide, sulphate), zinc. phos. (zinc phosphate, zinc phosphide), ac. hydroc. (acid hydrochloric, acid hydrocyanic diluted), ext. col. (extract colchicum, extract colocynth), sod. hypo. (sodium hyposulphite or hypophosphite), aq. fortis (for aq. fontis), etc.

6. *Essentials.*—After having made the diagnosis, then carefully consider the medicines most desirable, their demanded quantities and number of doses, trying never to prescribe more than necessary. See that the doses are neither too large nor follow each other so often as to endanger life—smaller and oft-repeated ones always being advisable. Avoid combining in one prescription medicines that will form poison-

ous compounds, have physiological incompatibilities, or will favor chemical decomposition. Let prescriptions be as simple as possible, having the smallest number of ingredients that will secure the desired effect. Always read them over carefully before finally handing same to attendant, and rewrite rather than permit a visible correction to exist. Large doses should always be underscored with a heavy line by the physician, and when desiring certain prescriptions not to be repeated, he should so mark the blank with the two words *non-repetatur*. When incompatibilities are intentional they should be so indicated by a marginal note; when otherwise the pharmacist will consider it his duty and privilege to make the necessary correction or remedy.

TABLE OF COMPARISON BETWEEN METRIC, AVOIRDUPOIS, AND APOTHECARIES' WEIGHTS.

Names.		Numerical Expressions.	Equivalents in Grains.	Equivalents in Avoirdupois Weight.			Equivalents in Apothecaries' Weight.		
		Gm.	Gr.	lb.	oz.	gr.	℥	ʒ	gr.
Milligramme,	Mg. (mg.)	0.001	0.01543	0	0	$\frac{1}{64}$	0	0	$\frac{1}{64}$
Centigramme,	Cg. (cg.)	0.01	0.15432	0	0	$\frac{1}{6}$	0	0	$\frac{1}{6}$
Decigramme,	Dg. (dg.)	0.1	1.54323	0	0	1.5	0	0	1.5
Gramme,	Gm. (gm.)	1.0	15.43235	0	0	15.4	0	0	15.4
Dekagramme,	Dg.	10.0	154.32356	0	$\frac{1}{4}$	45.0	0	2	34.0
Hectogramme,	Hg.	100.0	1543.23563	0	$3\frac{1}{2}$	12.0	3	1	43.0
Kilogramme,	Kg.	1000.0	15432.35639	2	$3\frac{1}{4}$	10.47	32	1	12.4
Myriagramme,	Mg.	10000.0	154323.56390	22	$\frac{1}{2}$	14.8	321	4	3.5

In writing prescriptions physicians usually consider 1 Gm. as being 15 gr., 4 Ml. (Cc.) as 1 fluidrachm, 30 Ml. (Cc.) as 1 fluidounce.

TABLE OF COMPARISON BETWEEN METRIC AND APOTHECARIES' FLUID MEASURE.

Millilitre (Cubic Centimetre).	Minims.	f℥	fʒ	♏
0.06163	1.0			
0.30815	5.0			
0.61630	10.0			
1.0	16.23			
5.0	81.15		1	21.15
10.0	162.30		2	42.3
20.0	324.60		5	24.6
30.0	486.90	1	0	6.9
40.0	649.20	1	2	49.2
50.0	811.50	1	5	31.5
60.0	973.80	2	0	13.8
70.0	1136.10	2	2	56.1
80.0	1298.40	2	5	38.4
90.0	1460.70	3	0	20.7
100.0	1623.00	3	3	3.0
250.0	4057.50	8	3	37.5
500.0	8115.00	16	7	15.0
1000.0	16230.00	33	6	30.0

CORRESPONDING VALUES WHICH SHOULD BE MEMORIZED BY EVERYONE.

1 millimetre, Mm. (mm.) = $\frac{1}{25}$ of an inch. 1 centimetre, Cm. (cm.) = $\frac{2}{5}$ of an inch.
1 inch = 25 millimetres or $2\frac{1}{2}$ centimetres.
1 cubic centimetre, Cc. (Ml.) = 16.23 minims. 1 fluidounce = 29.53 Cc. (Ml.).
1 gramme, Gm. (gm.) = 15.4324 grains. 1 grain = .0648 gramme.
1 milligramme, Mg. (mg.) = .01543 = $\frac{1}{64}$ grain. 1 litre, L. = 34 fluidounces = $2\frac{1}{8}$ pints.

Rule.—To convert grains (whole) into metric, multiply the metric equivalent of 1 grain—0.0648, by the number of grains in question, say 30, thus 0.0648 × 30 = 1.944 Gm.; for fractions of grains divide the denominator of the fraction into 0.0648, and multiply quotient by numerator—say $\frac{1}{64}$, thus 0.0648 ÷ 64 = 0.001 × 1 = 0.001 Gm.

MEASURES OF APPROXIMATION.

While these equivalents are not precisely accurate, their values have so long been recognized by laymen on the one hand, and physicians on the other, that they will possibly always be thus accepted:

A drop	♏j	.06	Ml. (Cc.)
A teaspoonful	fʒj	4	Ml. (Cc.)
A dessertspoonful	fʒij	8	Ml. (Cc.)
A tablespoonful	fʒiv	15	Ml. (Cc.)
A wineglassful	f℥ij	60	Ml. (Cc.)
A teacupful	f℥iv	120	Ml. (Cc.)
A tumblerful	f℥viij–xj	240–325	Ml. (Cc.)
A breakfastcupful	f℥viij	240	Ml. (Cc.)

Another likely source of error in weights and measures arises from quantities purchased in original containers from the manufacturers. Thus we speak of drachm vials of morphine sulphate, which in point of fact contain only one-eighth of 437.5 gr.—indeed, all solids when thus purchased have per ounce only the 437.5 gr., yet per pound sixteen times this amount, or 7,000 gr. With liquids the result is often much more misleading, especially of those having low or high specific gravities. These are sold mostly originally by weight, which causes the bulk often to be at variance with what some might expect.

1 ℔	473 Gm.	Sulphuric Acid	f℥8⅓	250	Ml. (Cc.)
1 ℔	473 Gm.	Liquor Ferri Subsulphatis	f℥10	296	Ml. (Cc.)
1 ℔	473 Gm.	Chloroform	f℥10⅓	305	Ml. (Cc.)
1 ℔	473 Gm.	Syrup Simple	f℥11¾	350	Ml. (Cc.)
1 ℔	473 Gm.	Glycerin	f℥12¼	360	Ml. (Cc.)
1 ℔	473 Gm.	Liquor Plumbi Subacetatis	f℥12⅞	380	Ml. (Cc.)
1 ℔	473 Gm.	Aqua Ammoniæ (10 p. c.)	f℥16	473	Ml. (Cc.)
1 ℔	473 Gm.	“ “ (28 p. c.)	f℥17	503	Ml. (Cc.)
1 ℔	473 Gm.	Spiritus Ætheris Nitrosi	f℥18¼	540	Ml. (Cc.)
1 ℔	473 Gm.	Essential Oil	f℥13–18	385–532	Ml. (Cc.)
1 ℔	473 Gm.	Æther	f℥21⅙	625	Ml. (Cc.)

TABLE GIVING THE MAXIMUM QUANTITIES THAT SHOULD BE PRESCRIBED UNLESS SPECIAL DIRECTIONS ACCOMPANY THE PRESCRIPTION.

	Single doses.			Total amount in any one day.		
Acid Arsenous	gr. ⅙	.01	Gm.	gr. ½	.03	Gm.
Acid Hydrocyanic Diluted	♏x	.6	Ml. (Cc.)	♏xxx	2	Ml. (Cc.)
Acid Nitromuriatic	♏v	.3	Ml. (Cc.)	♏xxx	2	Ml. (Cc.)
Aconite Leaf, Extract of	gr. 1½	.1	Gm.	gr. 10	.6	Gm.
Aconite Root, Fluidextract of	♏v	.3	Ml. (Cc.)	♏xv	1	Ml. (Cc.)
Aconite Root, Tincture of	♏vj	.4	Ml. (Cc.)	♏xv	1	Ml. (Cc.)
Aconite Root, Fleming's Tinc. of	♏iij	.2	Ml. (Cc.)	♏x	.6	Ml. (Cc.)
Aconitine and its salts	gr. $\frac{1}{50}$	.0013	Gm.	gr. $\frac{1}{10}$	.006	Gm.
Arsenic Chloride, Solution of	♏vj	.4	Ml. (Cc.)	♏xv	1	Ml. (Cc.)
Arsenic Iodide	gr. ⅙	.01	Gm.	gr. ½	.03	Gm.
Arsenic and Mercury, Solution of Iodides of	♏xx	1.3	Ml. (Cc.)	♏lx	4	Ml. (Cc.)
Arsenite of Potassium, Solution of	♏xv	1	Ml. (Cc.)	♏xlv	3	Ml. (Cc.)

	Single doses.		Total amount in any one day.	
Atropine and its salts	gr. $\frac{1}{60}$	.001 Gm.	gr. $\frac{1}{20}$	.003 Gm.
Belladonna, Extract of	gr. 1	.06 Gm.	gr. 5	.3 Gm.
Codeine	gr. 2	.13 Gm.	gr. 5	.3 Gm.
Coniine	gr. $\frac{1}{16}$	.004 Ml. (Cc.)	gr. $\frac{1}{2}$	.03 Ml. (Cc.)
Conium, Extract of	gr. 2	.13 Gm.	gr. 8	.5 Gm.
Croton Oil	♏ij	.13 Ml. (Cc.)		
Digitalin	gr. $\frac{1}{60}$	.001 Gm.	gr $\frac{1}{20}$	.003 Gm.
Digitalis, Extract of	gr.$\frac{1}{2}$	.03 Gm.	gr. 1	.06 Gm.
Hyoscyamus, Extract of	gr. 3	.2 Gm.	gr. 10	.6 Gm.
Ignatia, Extract of	gr. 3	.2 Gm.	gr. 10	.6 Gm.
Cannabis, Extract of	gr. 1	.06 Gm.	gr. 5	.3 Gm.
Corrosive Sublimate	gr. $\frac{1}{4}$	.016 Gm.	gr. $\frac{3}{4}$	.05 Gm.
Mercuric Iodide, Red	gr. $\frac{1}{4}$	.016 Gm.	gr. 1	.06 Gm.
Mercurous Iodide, Yellow	gr. 1	.06 Gm.	gr. 3	.2 Gm.
Morphine and its salts	gr. $\frac{1}{2}$	.03 Gm.	gr. 2	.13 Gm.
Nux Vomica, Extract of	gr. 2	.13 Gm.	gr. 8	.5 Gm.
Opium	gr. 2	.13 Gm.	gr. 10	.6 Gm.
Opium, Extract of	gr. 1	.06 Gm.	gr. 4	.26 Gm.
Opium, Tincture of	♏xxx	2 Ml. (Cc.)	♏cxx	8 Ml. (Cc.)
Phosphorus	gr. $\frac{1}{5}$	.013 Gm.	gr. $\frac{1}{2}$	.03 Gm.
Physostigma, Extract of	gr. $\frac{1}{4}$	.016 Gm.	gr. 1	.06 Gm.
Potassium Cyanide	gr. $\frac{1}{4}$	.016 Gm.	gr. 1	.06 Gm.
Sodium Arsenate	gr. $\frac{1}{3}$	.02 Gm.	gr. 1	.06 Gm.
Stramonium Leaves, Ext. of	gr. 2	.13 Gm.	gr. 5	.3 Gm.
Stramonium Seed, Ext. of	gr. 1	.06 Gm.	gr. 3	.2 Gm.
Strychnine and its salts	gr. $\frac{1}{12}$	.005 Gm.	gr. $\frac{1}{4}$	.016 Gm.
Tartar Emetic	gr. 2	.13 Gm.		
Veratrum viride, Fldext. of	♏iij	.2 Ml. (Cc.)	♏x	.6 Ml. (Cc.)
Veratrum viride, Tincture of	♏v	.3 Ml. (Cc.)	♏xij	.8 Ml. (Cc.)

DOSES OF RARE AND UNOFFICIAL DRUGS, SOME NOT TREATED OF IN THIS WORK.

Abrastol, gr. 15–20......1–2 Gm.
Acetal, ʒj–2......4–8 Ml. (Cc.).
Acet-ortho-toluide, gr. 2–5...... .13–.3 Gm.
Acet-para-toluide, gr. 15–30......1–2 Gm.
Acetyl-amido antipyrine, gr. 10–30. .6–2 Gm.
Acid anticylic, gr. $\frac{1}{100}$...... .0006 Gm.
Acid cathartinic, gr. 3–6...... .2–.4 Gm.
Acid cubebic, gr. 5–10...... .3–.6 Gm.
Acid fluoric dil., ♏x–20; .6–1.3 Ml. (Cc.)
Acid hydriodic dil., Ʒj ......4 Ml. (Cc.)
Acid hydrocinnamic, gr. 1–2. .06–.13 Gm.
Acid ortho-amido salicylic, gr. 2–5. .13–.3 Gm.
Acid osmic, gr. $\frac{1}{64}$...... .001 Gm.
Acid picric, gr. 1–5...... .06–.3 Gm.
Acid polygalic, gr. $\frac{1}{4}$–1...... .016–.06 Gm.
Adonin (adonidin), gr. $\frac{1}{16}$–$\frac{1}{3}$. .004–.02 Gm.
Agaricin, gr. $\frac{1}{2}$–2...... .03–.13 Gm.
Agathin, gr. 5–10...... .3–.6 Gm.
Alantol, gr. $\frac{1}{6}$...... .01 Gm.
Ammonium embelicum, gr. 2–6. .13–.4 Gm.
Ammonium picrate, gr. $\frac{1}{4}$–$\frac{1}{2}$......016–.03 Gm.
Ammonium salicylate, gr. 5–20. .3–1.3 Gm.
Ammonol, gr. 5–20...... .3–1.3 Gm.
Amyl valerate (valerianate), gr. 2–3. .13–.2 Gm.
Amylum iodatum, gr. 5–30...... .3–2 Gm.
Antikamnia, gr. 5–10...... .3–.6 Gm.
Antinervin, gr. 5–8...... .3–.5 Gm.
Antirheumatin, gr. 1–1$\frac{1}{2}$...... .06–.1 Gm.
Antispasmin, gr. $\frac{1}{6}$–1$\frac{1}{2}$...... .01–.1 Gm.
Antitetraizin, gr. 3–4...... .2–.26 Gm.
Antithermin, gr. 3...... .2 Gm.
Antitoxin, ʒj–2 ...... 4–8 Ml. (Cc.)
Apocodeine hydrochloride, gr. 1–1$\frac{1}{4}$. .06–.09 Gm.
Aralia hispida, gr. 20–40......1.3–2.6 Gm.
Aralia racemosa, gr. 20–40......1.3–2.6 Gm.
Arbutin, gr. 3–5...... .2–.3 Gm.
Arecoline, gr. $\frac{1}{20}$–$\frac{1}{16}$...... .003–.004 Gm.
Asparagin, gr. $\frac{1}{2}$–1$\frac{1}{2}$...... .03–.1 Gm.
Aspidospermine, gr. 1–2...... .06–.13 Gm.
Benzacetine, gr. 5–15 ...... .3–1 Gm.
Benzosol, gr. 4–8...... .26–.5 Gm.
Berberine, gr. $\frac{1}{2}$–1...... .03–.06 Gm.
Betol, gr. 5–8...... .3–.5 Gm.
Bismuth albuminate, gr. 8–15...... .5–1 Gm.
Bismuth benzoate, gr. 5–10...... .3–.6 Gm.
Bismuth cerium salicylate, gr. 15–30. 1–2 Gm.
Bismuth naphtholate, gr. 15–30...1–2 Gm.
Bismuth salicylate, gr. 5–30...... .3–2 Gm.
Bismuth sulphite, gr. 5–15 ...... .3–1 Gm.
Bismuth valerate (valerianate), gr. 1–3. .06–.2 Gm.
Boldin, gr. 1...... .06 Gm.
Boldoa fragrans, gr. 15–30...... 1–2 Gm.
Bromal hydrate, gr. 1–15...... .06–1 Gm.
Bromalin, gr. 30–60...... 2–4 Gm.

Bromamide, gr. 5–10 .... .3–.6 Gm.
Buxine, gr. 15–30 .... 1–2 Gm.
Cactus grandiflorus, gr. 5–10...... .3–.6 Gm.
Cæsium bitartrate, gr. 2–5 ...... .13–.3 Gm.
Caffeine chloral, gr. 3–5 .... .2–.3 Gm.
Caffeine tri-iodide, gr. 2–4..... .13–.26 Gm.
Calcium benzoate, gr. 10............... .6 Gm.
Calcium borate, gr. 3–6 .... .2–.4 Gm.
Calcium salicylate, gr. 8–24 ... .5–1.5 Gm.
Camphor salicylate, gr. 1–4... .06–.26 Gm.
Cannabinon, gr. $\frac{1}{2}$–1$\frac{1}{2}$ .... .03–.1 Gm.
Carniferrin, gr. 3–5 .... .2–.3 Gm.
Carpaine, gr. $\frac{1}{10}$–$\frac{1}{6}$ .... .006–.01 Gm.
Cerium nitrate, gr. 1–2......... .06–.13 Gm.
Cetrarin, gr. 1–3 .... .06–.2 Gm.
Chionanthus virginica, ʒss–1...... 2–4 Gm.
Chinoline salicylate, gr. 5–15 ... .3–1 Gm.
Chinoline tartrate, gr. 5–15 ...... .3–1 Gm.
Chloral ammonium, gr. 15–30......1–2 Gm.
Chlorphenol, ♏xv–30 ...... 1–2 Ml. (Cc.)
Cocaine borate, gr. $\frac{1}{8}$–2 ...... .008–.13 Gm.
Cocaine lactate, gr. $\frac{1}{8}$–2 ...... .008–.13 Gm.
Cocaine nitrate, gr. $\frac{1}{8}$–2 ...... .008–.13 Gm.
Cocaine saccharate, gr. $\frac{1}{8}$–2... .008–.13 Gm.
Codeine phosphate, gr. $\frac{1}{2}$–2... .03–.13 Gm.
Convolvulin, gr. 1–2 .... .06–.13 Gm.
Cornutine, gr. $\frac{1}{20}$–$\frac{1}{6}$ .... .003–.01 Gm.
Coronillin, gr. 1–2................ .06–.13 Gm.
Corydalis, gr. 10–30................. .6–2 Gm.
Creosote carbonate, ♏iij–15;.2–1 Ml. (Cc.)
Curare, gr. $\frac{1}{10}$–$\frac{1}{3}$ .... .006–.02 Gm.
Curarine, gr. $\frac{1}{64}$–$\frac{1}{32}$ .... .001–.002 Gm.
Cystine, gr. $\frac{1}{20}$–$\frac{1}{12}$............ .003–.005 Gm.
Cystine nitrate, gr. $\frac{1}{20}$–$\frac{1}{12}$... .003–.005 Gm.
Damiana, gr. 30–120................ .2–8 Gm.
Dioscorea, gr. 10–30 .... .6–2 Gm.
Dita bark, gr. $\frac{1}{2}$–3 .... .03–.2 Gm.
Drosera, gr. 5–10 .... .3–.6 Gm.
Erythrophlœine, gr. $\frac{1}{32}$–$\frac{1}{16}$... .002–.004 Gm.
Ethoxy caffeine, gr. 3.................. .2 Gm.
Eucalypteol, gr. 10–20 .... .6–1.3 Gm.
Euphorbia pilulifera, gr. 30–60 ... 2–4 Gm.
Ferratin, gr. 3–8 .... .2–.5 Gm.
Ferropyrine, gr. 5–15............... .3–1 Gm.
Fuchsine, gr. $\frac{1}{2}$–4....... .... .03–.26 Gm.
Gallo-bromol, gr. 15–120........... 1–8 Gm.
Gold bromide, $\frac{1}{20}$–$\frac{1}{10}$......... .003–.006 Gm.
Gold chloride, $\frac{1}{20}$–$\frac{1}{10}$ .... .003–.006 Gm.
Gold monocyanide, $\frac{1}{20}$–$\frac{1}{4}$... .003–.016 Gm.
Gold tricyanide, $\frac{1}{20}$–$\frac{1}{4}$........ .003–.016 Gm.
Gurjun balsam, ʒss–2 ....2–8 Ml. (Cc.)
Hæmogallol, gr. 3–5............... .2–.3 Gm.
Hæmol, gr. 1–8 .... .06–.5 Gm.
Hæmoglobin, gr. 1–3 ... . .06–.2 Gm.
Helenin, gr. $\frac{1}{6}$ .... .01 Gm.
Heliotropine, gr. 5–15.............. .3–1 Gm.
Homatropine, gr. $\frac{1}{120}$–$\frac{1}{60}$.. .0005–.001 Gm.
Homatropine hydrobromide, gr. $\frac{1}{120}$–$\frac{1}{60}$. .0005–.001 Gm.
Hydracetine, gr. $\frac{1}{2}$–1$\frac{1}{2}$ .... .03–.1 Gm.
Hydrangea, gr. 30–60................ 2–4 Gm.
Hydronaphthol, gr. 1–2........ .06–.13 Gm.
Iodo-caffeine, gr. 5 .... .3 Gm.
Iridin (irisin), gr. 1–4 .... .06–.26 Gm.
Iron benzoate, gr. 1–5 .... .06–.3 Gm.
Iron dialyzed, ♏v–30........3–2 Ml. (Cc.)
Iron magnetic oxide, gr. 5–10... .3–.6 Gm.
Iron malate, gr. 5–15................. .3–1 Gm.
Iron pomate, gr. 5–15 .... .3–1 Gm.
Kairin, gr. 2–10 .... .13–.6 Gm.
Kava-kava, gr. 10–30 .... .6–2 Gm.
Kosin, gr. 5–30 .... .3–2 Gm.
Lactol, gr. 3–8......................... .2–.5 Gm.
Lantanine, gr. 15–30 .... 1–2 Gm.
Lipanin, ʒj–4 ....4–15 Ml. (Cc.)
Lithium benzoate, gr. 5–15 ...... .3–1 Gm.
Lithium formate, gr. 3 .... .2 Gm.
Lithium salicylate, gr. 10–30..... .6–2 Gm.
Lithium sulphoichthyolate, gr. 5–8. .3–.5 Gm.
Lysidine, gr. 15–60.................. 1–4 Gm.
Magnesium lactate, gr. 15–45 ..... 1–3 Gm.
Magnesium phenolsulphonate, gr. 15–30. 1–2 Gm.
Magnesium salicylate, gr. 15–30.. 1–2 Gm.
Malakin, gr. 10–15.................... .6–1 Gm.
Malt extract, ʒj–2.............4–8 Ml. (Cc.)
Mercuric naphtholate, gr. 1........ .06 Gm.
Mercuric peptonate, gr. $\frac{1}{6}$........... .01 Gm.
Mercuric salicylate, gr. $\frac{1}{64}$–$\frac{1}{8}$. .001–.008 Gm.
Mercuric thymol-acetate, gr. $\frac{1}{12}$–$\frac{1}{6}$. .005–.01 Gm.
Mercuric thymolate, gr. $\frac{1}{12}$–$\frac{1}{6}$. .005–.01 Gm.
Mercurous acetate, gr. $\frac{1}{6}$–1..... .01–.06 Gm.
Mercurous tannate, gr. 1–2..... .06–.13 Gm.
Mercury amido-propionate, gr. $\frac{1}{12}$–$\frac{1}{6}$. .005–.01 Gm.
Mercury phenolate, gr. $\frac{1}{4}$–$\frac{1}{2}$... .016–.03 Gm.
Mercury formamidate (1 p. c. sol.), ♏v–15 .... .3–1 Ml. (Cc.)
Mercury imido-succinate, gr. $\frac{1}{12}$–$\frac{1}{6}$, .005–.01 Gm.
Mercury sozo-iodolate, gr. 1 ...... .06 Gm.
Methylene blue, gr. 2–8 .... .13–.5 Gm.
Methoxy caffeine, gr. 2–4...... .13–.26 Gm.
Migranin, gr. 10–15 .... .6–1 Gm.
Morphine benzoate, gr. $\frac{1}{6}$–$\frac{1}{4}$. .01–.016 Gm.
Morrhuol, gr. 1–5 .... .06–.3 Gm.
Myrtol, ♏v .... .3 Ml. (Cc.)
Naphtol, gr. 5–15...................... .3–1 Gm.
Narceine hydrochloride, gr. $\frac{1}{6}$–1. .01–.06 Gm.
Narcotine, gr. 3–10 .... .2–.6 Gm.
Neurodine, gr. 10–20 .... .6–1.3 Gm.
Oleo-creosote, ♏v–15 ...... .3–1 Ml. (Cc.)
Orexine, gr. 2–6 .... .13–.4 Gm.
Orthine, gr. 3–8........................ .2–.5 Gm.
Ouabain, gr. $\frac{1}{1000}$ .... .00006 Gm.
Oxy-sparteine, gr. $\frac{1}{2}$–1$\frac{1}{2}$ .... .03–.1 Gm.
Papain, gr. 2–5 .... .13–.3 Gm.
Papayotin, gr. 2–5 .... .13–.3 Gm.
Paracresalol, gr. 3–30 .... .2–2 Gm.
Phenidin, gr. 5–15 .... .3–1 Gm.
Phenyl ester of anisic acid, gr. 8–15. .5–1 Gm.
Phloridzin, gr. 5–10 .... .3–.6 Gm.
Phytolaccin, gr. 2–3 .... .13–.2 Gm.
Piliganine hydrochloride, gr. $\frac{1}{6}$–$\frac{1}{3}$. .01–.02 Gm.

Potassium cobalto-nitrite, gr. $\frac{1}{2}$..... .03 Gm.
Potassium osmate, gr. $\frac{1}{64}$........... .001 Gm.
Propylamine, gr. 30–60 .... 2–4 Gm.
Pyoktanin, gr. 1–5 .... .06–.3 Gm.
Pyrazol, gr. 15–30.................... 1–2 Gm.
Pyridine, ♏j–3............06–.2 Ml. (Cc.)
Quinine arsenite, gr. $\frac{1}{12}$–$\frac{1}{2}$ ... .005–.03 Gm.
Quinine salicylate, gr. 1–8...... .06–.5 Gm.
Quinine tannate, gr. 3–8 .... .2–.5 Gm.
Retinol, gr. 1.......................... .06 Gm.
Rubidium ammonium bromide, gr. 15–20. 1–1.3 Gm.
Rubidium iodide, gr. 1–2...... .06–.13 Gm.
Salicylamide, gr. 2–5 .... .13–.3 Gm.
Santoninoxime, gr. 1–2......... .06–.13 Gm.
Scillain, gr. $\frac{1}{6}$–$\frac{3}{4}$................. .01–.05 Gm.
Scillipicrin, gr. $\frac{1}{60}$ .... .001 Gm.
Sodium anisate, gr. 10–15......... .6–1 Gm.
Sodium di-thio-salicylate, gr. 3...... .2 Gm.
Sodium para-cresotate, gr. 30–90. 2–6 Gm.
Sodium sulfo-caffeate, gr. 15 .... 1 Gm.
Solanine, gr. $\frac{1}{6}$–1................. .01–.06 Gm.
Somatose, ʒss–8 .... 2–30 Gm.
Sulphaminol, gr. 2–4 .... .13–.26 Gm.
Tartar-lithine, gr. 5–10............ .3–.6 Gm.
Tartar-lithine and sulphur, gr. 5–10. .3–.6 Gm.
Terpinol, gr. 5–15 .... .3–1 Gm.
Thalline tartrate, gr. 2–8........ .13–.5 Gm.
Thermifugin, gr. 1–4 .... .06–.26 Gm.
Thermodin, gr. 5–15 .... .3–1 Gm.
Thiol, gr. 2–10...................... .13–.6 Gm.
Thymacetin, gr. 3–10 .... .2–.6 Gm.
Tolypyrine, gr. 8–30 .... .5–2 Gm.
Tolysal, gr. 15–30 .... 1–2 Gm.
Tussol, gr. 2–8...................... .13–.5 Gm.
Uropherin, gr. 10–15................ .6–1 Gm.
Vieirin, gr. 1–3 .... .06–.2 Gm.

TABLE SHOWING THE NUMBER OF DROPS IN A FLUIDRACHM OF VARIOUS LIQUIDS, WITH THE WEIGHT OF ONE FLUIDRACHM OF EACH IN GRAINS AND IN GRAMMES.

	Drops in fʒj. (60 m.)	Weight of fʒj in	
		grains.	grammes.
Acetum opii	90	61	3.95
Acetum sanguinariæ	78	55½	3.59
Acetum scillæ	68	57	3.69
Acidum aceticum	108	58	3.75
Acidum aceticum dilutum	68	55	3.56
Acidum hydrochloricum	70	65	4.21
Acidum hydrochloricum dilutum	60	56	3.62
Acidum hydrocyanicum dilutum	45	54	3.49
Acidum lacticum	111	66	4.27
Acidum nitricum	102	77	4.98
Acidum nitricum dilutum	60	58	3.62
Acidum nitrohydrochloricum	76	66	4.27
Acidum phosphoricum dilutum	59	57	3.69
Acidum sulphuricum	128	101	6.54
Acidum sulphuricum aromaticum	146	53	3.43
Acidum sulphuricum dilutum	60	58½	3.79
Acidum sulphurosum	59	55	3.56
Æther fortior	176	39	2.52
Alcohol	146	44	2.85
Alcohol dilutum	137	49	3.17
Aqua	60	55	3.56
Aqua ammoniæ fortior	66	50	3.24
Balsamum peruvianum	101	60	3.88
Bromum	250	165	10.69
Chloroformum purificatum	250	80	5.18
Copaiba	110	51	3.30
Creosote	122	56½	3.66
Fluidextractum belladonnæ	156	57	3.69
Fluidextractum buchu	150	47½	3.07
Fluidextractum cinchonæ	138	58	3.75
Fluidextractum colchici radicis	160	57	3.69
Fluidextractum colchici seminis	158	55	3.56
Fluidextractum conii fructus	137	61	3.93
Fluidextractum digitalis	134	62	4.01
Fluidextractum ergotæ	133	60	3.88
Fluidextractum gelsemii	149	49	3.14
Fluidextractum glycyrrhizæ	133	61	3.95
Fluidextractum hyoscyami	160	59	3.82

	Drops in fʒj. (60 m.)	Weight of fʒj in	
		grains.	grammes.
Fluidextractum ipecacuanhæ	120	60	3.88
Fluidextractum pareiræ	140	57	3.72
Fluidextractum rhei	158	61	3.95
Fluidextractum sarsaparillæ compositum	134	60	3.88
Fluidextractum senegæ	137	62	4.01
Fluidextractum serpentariæ	148	47	3.07
Fluidextractum uvæ-ursi	137	60	3.88
Fluidextractum valerianæ	150	49	3.17
Fluidextractum veratri	150	50	3.24
Fluidextractum zingiberis	142	48	3.11
Glycerinum	67	68	4.40
Hydrargyrum	150	760	49.24
Liquor acidi arsenosi	57	55	3.56
Liquor ammonii acetatis	75	56	3.62
Liquor arseni et hydrargyri iodidi	58	55	3.56
Liquor ferri chloridi	71	72	4.66
Liquor ferri citratis	71	72	4.66
Liquor ferri nitratis	59	59	3.82
Liquor ferri subsulphatis	73	83	5.37
Liquor ferri tersulphatis	83	72	4.66
Liquor hydrargyri nitratis	131	123	7.97
Liquor iodi compositus	63	59	3.82
Liquor plumbi subacetatis	74	70	4.53
Liquor potassii hydroxidi	62	58	3.75
Liquor potassii arsenitis	57	55	3.56
Liquor sodæ chlorinatæ	63	62	4.01
Liquor zinci chloridi	89	88	5.70
Oleoresina aspidii	130	52	3.36
Oleoresina capsici	120	51	3.30
Oleoresina cubebæ	123	52	3.36
Oleum æthereum	125	50	3.24
Oleum amygdalæ amaræ	115	55	3.56
Oleum amygdalæ expressum	108	48½	3.14
Oleum anisi	119	54	3.49
Oleum aurantii corticis	120	54	3.49
Oleum bergamottæ	130	46	2.98
Oleum cari	132	50	3.24
Oleum caryophylli	130	57	3.69
Oleum chenopodii	97	50	3.24
Oleum cinnamomi	126	53½	3.46
Oleum copaibæ	123	49½	3.20
Oleum cubebæ	125	51	3.30
Oleum fœniculi	125	53	3.43
Oleum gaultheriæ	125	62	4.01
Oleum juniperi	148	49	3.17
Oleum lavandulæ florum	138	52	3.36
Oleum limonis	129	47	3.04
Oleum menthæ piperitæ	129	50	3.24
Oleum olivæ	76	51	3.33
Oleum ricini	77	51½	3.33
Oleum rosæ	132	47	3.04
Oleum rosmarini	143	50	3.24
Oleum sabinæ	102	54	3.49
Oleum sassafras	133	58	3.75
Oleum terebinthinæ	136	45½	2.94
Oleum tiglii	104	50	3.24
Phenol (acidum carbolicum)	111	59	3.82
Spiritus ætheris compositus	148	45	2.91
Spiritus ætheris nitrosi	146	47	3.04
Spiritus ammoniæ aromaticus	142	48	3.11
Spiritus camphoræ	143	47	3.04
Spiritus chloroformi	150	48	3.11
Spiritus menthæ piperitæ	142	47	3.04

	Drops in fʒj. (60 m.)	Weight of fʒj in	
		grains.	grammes
Syrupus acaciæ	44	73	4.73
Syrupus ferri iodidi	65	77	4.98
Syrupus scillæ	75	74	4.79
Syrupus scillæ compositus	102	70	4.53
Syrupus senegæ	106	70	4.53
Syrupus simplex	65	72	4.66
Tinctura aconiti	146	46	2.98
Tinctura asafœtidæ	120	54	3.49
Tinctura belladonnæ foliorum	137	53	3.43
Tinctura benzoini composita	148	48	3.11
Tinctura cantharidis	131	51	3.33
Tinctura cinchonæ composita	140	49	3.17
Tinctura digitalis	128	53	3.43
Tinctura ferri chloridi	150	53	3.43
Tinctura guaiaci	130	46	2.98
Tinctura iodi	148	47	3.04
Tinctura nucis vomicæ	140	44	2.85
Tinctura opii	130	53	3.43
Tinctura opii camphorata	130	52	3.36
Tinctura opii deodorata	110	54	3.49
Tinctura tolutana	130	46	2.98
Tinctura valerianæ	130	52	2.36
Tinctura veratrum viride	145	46	2.98
Tinctura zingiberis	144	46	2.98
Vinum antimonii	72	50	3.24
Vinum colchici radicis	107	55	3.56
Vinum colchici seminis	111	54	3.49
Vinum opii	100	55	3.56

TABLE OF THERMOMETRIC EQUIVALENTS.

(Fahrenheit and Centigrade Scales.)

F.	C.	F.	C.	F.	C.	F.	C.	F.	C.	F.	C.
212 =	100	174 =	79	136 =	58	99 =	37	61 =	16	23 =	— 5
210 =	99	172 =	78	135 =	57	97 =	36	59 =	15	21 =	— 6
208 =	98	171 =	77	133 =	56	95 =	35	57 =	14	19 =	— 7
207 =	97	169 =	76	131 =	55	93 =	34	55 =	13	18 =	— 8
205 =	96	167 =	75	129 =	54	91 =	33	54 =	12	16 =	— 9
203 =	95	165 =	74	127 =	53	90 =	32	52 =	11	14 =	—10
201 =	94	153 =	73	126 =	52	88 =	31	50 =	10	12 =	—11
199 =	93	162 =	72	124 =	51	86 =	30	48 =	9	10 =	—12
198 =	92	160 =	71	122 =	50	84 =	29	46 =	8	9 =	—13
196 =	91	158 =	70	120 =	49	82 =	28	45 =	7	7 =	—14
194 =	90	156 =	69	118 =	48	81 =	27	43 =	6	5 =	—15
192 =	89	154 =	68	117 =	47	79 =	26	41 =	5	3 =	—16
190 =	88	153 =	67	115 =	46	77 =	25	39 =	4	1 =	—17
189 =	87	151 =	66	113 =	45	75 =	24	37 =	3	— 1 =	—18
187 =	86	149 =	65	111 =	44	73 =	23	36 =	2	— 2 =	—19
185 =	85	147 =	64	109 =	43	72 =	22	34 =	1	— 4 =	—20
183 =	84	145 =	63	108 =	42	70 =	21	32 =	0	—11 =	—24
181 =	83	144 =	62	107 =	41	68 =	20	30 =	—1	—31 =	—35
180 =	82	142 =	61	104 =	40	66 =	19	28 =	—2	—35 =	—37
178 =	81	140 =	60	102 =	39	64 =	18	27 =	—3	—40 =	—40
176 =	80	138 =	59	100 =	38	63 =	17	25 =	—4		

To convert Fahrenheit to Centigrade, subtract 32, multiply by 5, and divide by 9.
To convert Centigrade to Fahrenheit, multiply by 9, divide by 5, and add 32.

Popular Medical Abbreviations.

āā.	Ana	Of each.
Abs. febr.	Absente febre	Fever being absent.
Ad.	Adde	Add up to.
Ad 2 vic.	Ad duas vices	At two doses.
Ad sec. vic.	Ad secundum vicem	For twice.
Ad ter vic.	Ad tertiam vicem	For thrice.
Ad lib.	Ad libitum	At pleasure.
Ad us.	Ad usum	According to custom.
Adst. febre	Adstante febre	Fever present.
Aeq.	Æquales	Equal.
Agit. vas.	Agitato vase	Shaking the vial.
Alt. hor.	Alternis horis	Every other hour.
Aliq.	Aliquot	Some, a few.
Alv. adst.	Alvo adstricta	Bowels confined.
Ampul.	Ampulla	A large bottle.
Aq.	Aqua	Water.
Aq. astr.	Aqua astricta	Frozen water.
Aq. bull.	Aqua bulliens	Boiling water.
Aq. comm.	Aqua communis	Common water.
Aq. ferv.	Aqua fervens	Hot water.
Aq. fluv.	Aqua fluvialis (fluviatilis)	River water.
Aq. font.	Aqua fontalis (fontana)	Spring water.
Aq. lac.	Aqua lacalis	Lake water.
Aq. mar.	Aqua marina	Sea water.
Aq. niv.	Aqua nivalis	Snow water.
Aq. pluv.	Aqua pluvialis (pluviatilis)	Rain water.
Aut	Aut	Or.
Bals.	Balsamum	Balsam.
Bib.	Bibe	Drink.
Bid.	Biduum	Two days.
Bis	Bis	Twice.
Bis in d.	Bis in die (indies)	Twice daily.
Bis in 7 d.	Bis in septem diebus	Twice a week.
Bol.	Bolus	A large pill.
Bull.	Bulliat (bulliant)	Let boil.
But.	Butyrum	Butter.
C.	Cum	With.
C. m.	Cras mane	To-morrow morning.
C. m. s.	Cras mane sumendus	Take to-morrow morning.
C. n.	Cras nocte	To-morrow night.
C. v.	Cras vespere	To-morrow evening.
Cærul.	Cæruleus	Blue.
Cal.	Calomelas	Calomel.
Cap.	Capiat (Cape)	Let him (her) take.
Cap.	Capsula	A capsule.
Caute	Caute	Cautiously.
Chart.	Charta	Paper.
Chartul.	Chartula	Small paper.
Cib.	Cibus	Food.
Coch.	Cochleare	A spoonful.
Coch. ampl.	Cochleare amplum	A tablespoonful.
Coch. infant.	Cochleare infantis	A teaspoonful.
Coch. mag.	Cochleare magnum	A tablespoonful.
Coch. mod.	Cochleare modicum	A dessertspoonful.
Coch. parv.	Cochleare parvum	A teaspoonful.
Coct.	Coctio	Boiling.
Col.	Cola	Strain.
Colatur.	Colaturæ	To the strained liquor.
Collut.	Collutorium	A mouth wash.
Collyr., coll.	Collyrium	An eye wash.
Comp.	Compositus	Compound, compounded.
Con., concis.	Concisus	Cut.
Conf.	Confectio	Confection.
Contin.	Continueter	Let it be continued.

Cont. rem.	Continuantur remedia	Let medicines be continued.
Coq.	Coque, coquantur	Boil.
Cort.	Cortex	The bark.
Crast., cras.	Crastinus	To-morrow.
Crast.	Crastinus (cras)	Early to-morrow.
Cuj.	Cujus	Of which.
Cyath.	Cyathus	A glassful.
Cyatho theæ	Cyatho theæ	In a cup of tea.
Cyath. (c.) vinar.	Cyathus vinarius	A wineglassful.
D.	Dosis	A dose.
De d. in d.	De die in diem	From day to day.
D., det.	Da, detur	Give; let it be given.
De	De	Of or from.
Deaur. pil.	Deaurentur pilulæ	Let the pills be gilded.
Deb. spiss.	Debita spissitudo	A proper consistence.
Dec.	Decanta	Pour off.
Decim.	Decimus	Ten, the tenth.
Decoct.	Decoctum	A decoction.
Deglut.	Deglutiatur	Let it be swallowed.
D. t. d. No. 4.	Dentur tales doses No. 4.	Take 4 such doses.
Dieb. alt.	Diebus alternis	On alternate days.
Dieb. tert.	Diebus tertiis	Every third day.
Dil.	Dilue, dilutus	Dilute, diluted.
Dim.	Dimidius	One-half.
Disp.	Dispensa, dispensetur	Dispense, let it be dispensed
D. D. or direc. prop.	Directione propriâ	With proper direction.
D. in p. æq.	Dividatur in partes æquales.	Divide in equal parts.
Div., divid.	Dividendus	Divide, to be divided.
Don.	Donec	Until.
Dur. dolor.	Durante dolore	During the pain.
Ead.	Eadem	The same.
Elect.	Electuarium	An electuary.
En., enem.	Enema (enemata)	An enema, a clyster.
Et	Et	And.
Exhib.	Exhibeatur	Let it be exhibited.
Ext.	Extende (extendatur)	Spread.
Extr.	Extractum	An extract.
F., Ft.	Fac, fiat, fiant	Make, let it be made.
F. ft. pil. 12	Fac pilulas duodecim	Make 12 pills.
Far.	Farina	Flour.
Feb. dur.	Febre durante	During the fever.
Ferv.	Fervens	Boiling.
F. (Ft.) cataplasm	Fiat cataplasma	Make a poultice.
Ft. cerat.	Fiat ceratum	Make a cerate.
Ft. chart. 12	Fiant chartulæ duodecim	Make 12 powders.
Ft. collyr.	Fiat collyrium	Make an eye wash.
Ft. confec.	Fiat confectio	Make a confection.
Ft. elect.	Fiat electuarium	Make an electuary.
Ft. emp. 3 x 6	Fiat emplastrum 3 x 6	Make a plaster 3 x 6 inches.
Ft. emuls.	Fiat emulsio	Make an emulsion.
Ft. garg.	Fiat gargarisma	Make a gargle.
Ft. h. (haust.)	Fiat haustus	Make a draught.
Ft. infus.	Fiat infusum	Make an infusion.
Ft. inject.	Fiat injectio	Make an injection.
Ft. m. (mist.)	Fiat mistura	Make a mixture.
Ft. pil.	Fiat pilula	Make a pill.
F. L. A.	Fiat lege artis	Make by rules of art.
Ft. linim.	Fiat linimentum	Make a liniment.
Ft. (mas.) massa.	Fiat massa	Make a mass.
Ft. mas. div. in pil. 12	Fiat massa in pilulas duodecim dividenda	Make 12 pills.
Ft. pulv.	Fiat pulvis	Make a powder.
Ft. pulv. et div. in chart. 12.		Make 12 powders.
Ft. solut.	Fiat solutio	Make a solution.
Ft. suppos. 4	Fiant suppositora quatuor	Make 4 suppositories.
Ft. troch. 12	Fiat trochisci duodecim	Make 12 lozenges.

Ft. ung.	Fiat unguentum	Make an ointment.
Filtra.	Filtram	Filter (thou), a filter.
Fl., Fld.	Fluidus	Liquid.
Form.	Formula	A prescription.
Garg.	Gargarisma	A gargle.
Gr.	Granum, Grana	Grain, grains.
Grat.	Gratus	Pleasant.
Gtt.	Gutta, guttæ	A drop, drops.
Guttat.	Guttatim	By drops.
Habt.	Habeat	Let him have.
Haust.	Haustus	A draught.
H.	Hora	An hour.
H. s. (hor. som.)	Hora somni	Before going to sleep.
H. d.	Hora decubitus	Hour of retiring.
Hor. interm.	Horis intermediis	At intermediate hours.
Ind.	In dies (indies)	Daily.
Inf.	Infunde	Pour in.
Infus.	Infusum	An infusion.
Injec.	Injectio	An injection.
Int.	Internus	Inner, internal.
Jent.	Jentaculum	Breakfast.
Jux.	Juxta (juxtim)	Near to.
Kali ppt.	Kali præparatum	Prepared kali = K_2CO_3.
Lac.	Lactis	Milk.
Lat. dol.	Lateri dolenti	To the painful side.
Lin.	Linimentum	A liniment.
Liq.	Liquor	A solution.
Lot.	Lotio	A lotion.
Mac.	Macera	Macerate.
Mag.	Magnus	Large.
M., man.	Manipulus	A handful.
Manus	Manus	The hand.
Mas., mass	Massa (pilularis)	A mass—a pill mass.
Mensur., mens.	Mensura	By measure.
Mic. pan.	Mica panis	Crumb of bread.
M., min.	Minimum	A minim.
Minut.	Minutum	A minute.
M.	Misce	Mix.
Mist.	Mistura	A mixture.
Mitte.	Mittatur	Send, let it be sent.
Mit. tal.	Mitte talis	Send of such like.
Mod. præsc.	Modo præscripto	In manner prescribed.
More dict.	More dictu	In manner directed.
Non	Non	Not.
Non repetat.	Non repetatur	Let it not be repeated.
No.	Numerus (numero)	Number.
N. a.		Numerical aperture.
N. F.		National Formulary.
O.	Octarius	A pint.
Omn. hor.	Omni hora	Every hour.
O. m.	Omni mane	Every morning.
Omn. bih.	Omni bihora	Every two hours.
O. n.	Omni nocti	Every night.
P. æ.	Partes æquales	Equal parts.
Part. vic.	Partitis vicibus	In divided doses.
P., pt.	Perstetur	Continue.
Penicil. cam.	Penicillum camelinum	Camel's hair pencil.
Pas., pastil.	Pastillum, pastillus	A small lozenge.
P. P. A.	Phiala prius agitata	First shaking the bottle.
Pil.	Pilula	A pill.
Pocul., pocill., poc.	Poculum, pocillum	A cup, a little cup.
P.	Pondere	By weight.
Pone aur.	Pone aurem	Behind the ear.
Pot.	Potus	Drink.
Præp.	Præparat(us)-a	Prepared.
Prand.	Prandium	Dinner.

Prim. man.	Primo mane	Early in the morning.
Pro rat. æt.	Pro ratione ætatis	According to the age of the patient.
P. r. n.	Pro re nata	When necessary.
Pug.	Pugillus	A pinch.
Pulv.	Pulvis, pulverizatus	A powder, powdered.
Pyx.	Pyxis	A pill box.
Q. l.	Quantum libet	As much as is required.
Q. p.	Quantum placet	As much as is required.
Q. v.	Quantum vis, volueris	As much as is required.
Q. s.	Quantum sufficit	A sufficient quantity.
Qq. hor.	Quaqua hora	Each, every hour.
Q. q.	Quoque, quaque	Also—each, every.
Rec.	Recens	Fresh.
℞.	Recipe	Take.
Rept.	Repetatur	Let it be repeated.
Scat.	Scatula	A box.
S. a.	Secundum artem	According to art.
S. n.	Secundum naturam	According to nature.
Ss.	Semis	A half.
Semih.	Semihora	Half an hour.
Sesqh.	Sesquihora	A hour and a half.
Sig.	Signa	Mark thou, sign.
Sing.	Singulorum	Of each.
Si n. val.	Si non valeat	If it does not answer.
Si op. sit.	Si opus sit	If necessary.
Solv.	Solve, solvetur	Dissolve.
Stat.	Statim	Immediately.
St.	Stet, stent	Let it stand.
S. s. s.	Stratum superstratum	Layer upon layer.
Sum.	Sume, sumat sumendus	Take, let it be taken.
Summit.	Summitates	The summits, tops.
Sup.	Super, supra	Above.
Tal.	Talis	Such, like this.
T. i. d. or t. d.	Ter (in) die	Three times a day.
Tinct., tr.	Tinctura	Tincture.
Trit.	Tritura	Triturate.
Troch.	Trochisci	Lozenges.
Ter.	Tere	Rub.
Ter. bene	Tere bene	Rub well.
Ult. præsc.	Ultimo præscriptus	The last ordered.
Una	Una	Together.
Unc.	Uncia	An ounce.
Utend.	Utendum	To be used.
Ut Dict.	Ut dictum	As directed.
U. S. P.		United States Pharmacopœia.
Vehic.	Vehiculum	A vehicle.
Vel	Vel	Or.
Vesp.	Vesper, vesperis	The evening.
Vom. urg.	Vomitione urgente	The vomiting being troublesome.

Some Leading Official Organic Drugs whose Medicinal Properties Depend upon One or More Specific Constituents.

1. *Sugar.*

Fig, Honey, Manna, Prune, Triticum.

2. *Sugar + Acid.*

Cassia Fistula, Lemon Juice, Phytolacca Fruit, Raspberry, Tamarind, Rhus Glabra.

3. *Mucilage.*

Althæa, Cetraria, Chondrus, Elm, Sassafras Pith, Acacia, Tragacanth.

4. *Volatile Oil.*

Anise (1–3 p. c.), Buchu (1–1.6 p. c.), Calamus (1–3.5 p. c.), Caraway (5–7 p. c.), Cardamom (5 p. c.), Cascarilla (1.6 p. c.), Chenopodium (3–3½ p. c.), Cinnamon (½–2 p. c.), Cloves (18 p. c.), Coriander (½–1 p. c.), Cubeb (5–15 p. c.), Eriodictyon, Eucalyptus (6 p. c.), Fennel (2–6 p. c.), Garlic (¼ p. c.), Ginger (1–3 p. c.), Hedeoma (1 p. c.), Illicium (2–5 p. c.), Lemon Peel (2 p. c.), Mace (8 p. c.), Marrubium, Melissa (¼ p. c.), Mustard, Nutmeg (2–8 p. c.), Orange Peel (Bitter), Orange Peel (Sweet), Pepper (1–2 p. c.), Peppermint (1 p. c.), Pimenta (3–4 p. c.), Rose Pale, Rose Red (.05 p. c.), Saffron (1 p. c.), Salvia (½–2 p. c.), Sambucus, Sassafras (6–9 p. c.), Scutellaria, Spearmint (½ p. c.), Sumbul (⅓–1 p. c.), Tansy (¼ p. c.), Valerian, Vanilla (½–2 p. c.).

5. *Concrete Volatile Oil.*

Camphor, Menthol, Thymol.

6. *Resin.*

Guaiac, Mastic, Rosin, Aspidium, Cascara Sagrada, Caulophyllum, Cimicifuga, Cottonroot Bark, Frangula, Jalap, Kamala, Podophyllum, Pulsatilla, Pumpkin Seed, Stillingia.

7. *Oleoresin.*

Copaiba (oil, 20–90 p. c.), Turpentine (oil, 20–30 p. c.), Turpentine Canada (oil, 24 p. c.), Burgundy, Pitch, Tar.

8. *Gumresin.*

Gamboge (gum, 16–25 p. c., resin, 66–80 p. c.), Scammony (gum, 3–8 p. c., resin, 75–90 p. c.), India Rubber (resin, 32 p. c.).

9. *Gum, Resin, + Volatile Oil.*

Ammoniac (gum, 18–28 p. c., resin, 70 p. c., vol. oil, 1–4 p. c.), Asafetida (gum, 20–30 p. c., resin, 60–70 p. c., vol. oil, 6–9 p. c.), Myrrh (gum, 40–60 p. c., resin, 25–40 p. c., vol. oil, 4–8 p. c.).

10. *Balsam.*

Benzoin (benzoic acid, 10–20 p. c.), Balsam of Peru (resin, 16–25 p. c., cinnamein, 56–66 p. c.), Balsam of Tolu (vol. oil, 1 p. c.), Storax.

11. *Volatile Oil (Resin) + Bitter Principle.*

Absinthium, Arnica, Asclepias, Chamomile, Cypripedium, Grindelia, Hamamelis, Inula, Iris, Lappa, Lupulin, Matico, Matricaria, Mezereum, Phytolacca Root, Pyrethrum, Serpentaria, Xanthoxylum, Cusso, Cannabis.

12. *Fixed Oil +.*

Aspidium, Cottonroot Bark, Flaxseed, Lycopodium, Pumpkin Seed, Pyrethrum, Stillingia, Sweet Almond, Vanilla.

13. *Tannic or Gallic Acid.*

Castanea, Catechu, Gambir, Geranium, Hæmatoxylon, Kino, Krameria, Nutgall, White Oak, Wild Cherry, Rubus, Rumex.

14. *Glucoside.*

Aloes, Apocynum, Araroba, Bryonia, Calendula, Calumba, Dulcamara, Capsicum, Chimaphila, Chirata, Colocynth, Convallaria, Corn Silk, Digitalis, Ergot, Euonymus, Eupatorium, Glycyrrhiza, Juglans, Leptandra, Quillaja, Rhubarb, Rhus Toxicodendron, Santonica, Sarsaparilla, Senega, Senna, Squill, Strophanthus, Taraxacum, Uva Ursi, Vanilla, Viburnum, Prunifolium, Cascarilla, Wild Cherry, Cetraria, Caulophyllum, Clove, Cubeb, Frangula, Guarana, Kamala, Quassia, Phytolacca.

15. *Alkaloid.*

Aconite, Aspidosperma, Belladonna, Chelidonium, Cinchona, Colchicum, Conium, Coca, Calumba, Gelsemium, Guarana, Hydrastis, Hops, Hyoscyamus, Ipecac, Lobelia, Menispermum, Nux Vomica, Opium, Pareira, Pepper, Physostigma, Pilocarpus, Pomegranate, Sanguinaria, Scoparius, Spigelia, Staphisagria, Stramonium, Tobacco, Veratrum viride.

THE PRONUNCIATION OF SOME IMPORTANT WORDS USED IN THIS WORK.

Ab-i-et′ic.
Ab′i-e-tin.
Ab′rin.
Ac-et-an′i-lid(e)—(As).
Ach-il-le′ine.
Ad-on′id-in.
Ad-ren′a-lin.
A′gar-a′gar.
A-gar′i-cin.
Ag′a-thin.
A-lan′tol.
Al-cor-no′que (ka).
A-liz′a-rin (Al-i-za′rin).
Am′pul.
A-myg′da-lin.
An-drom-e-do-tox′in.
An-e-mon′ic.
A-nem-o-nin′ic.
An′e-thol.
An-them′ene.
An-them′ic.
An-them′i-din.
An-them′ol.
An-thra-ro′bin.
A′pi-in.
Ap′i-ol.
Ap-i-ol′ic.
Ap-i-ol′in.
Ap-o-at′ro-pine.
A-poc-y-ne′in
(A-po-cyn′e-in).
A-poc′y-nin—(pos′).
Ap-o-ret′in.
Ar′a-chin.
Ar′bu-tin.
Ar-gyr′i-a.
Ar′gy-rol.
Ar′is-tol.
Ar-tem′i-sin.
As′a-prol.
As-cle-pi′a-din
(As-cle-pi-a′din).
A-sel′line.
A-sep′tol.
As-pid-os′a-mine.
As-pid-o-sper′ma-tine.
As-pid-o-sper′mine.
A-tro-pa′mine.
A-tro-pur-pu′rin.
At′ro-sin.

Bal-sam-i′to.
Bas′so-rin.
Bdel′li-um—(Del′).
Ben-zac′o-nine.
Benz-al′co-hol.
Ben-zan′i-lide.

Ber-ga′mi-ol.
Ber-gap′tene.
Be′ta-ine.
Be′tol.
Bil-i-neu′rine.
Bil-i-ru′bin.
Bor′ne-al.
Bry-oi′din.

Cab′al-line.
Cac-o-dyl′ate.
Caf-fe′id-ine.
Caj′e-pu-tol.
Cal-a-bar′ine.
Caout′chouc (Koo′chook).
Cap-ron′ic.
Ca-pryl′ic.
Cap-sa′i-cin.
Cap′si-cine.
Ca-ra′cas.
Car-min′ic.
Car-nau′bic.
Car-ra-gee′nin.
Car′ra-gen.
Car′tha-mine.
Car-y-o-phyl′lene.
Car-y-o-phyl′lin.
Ceph-a-e′line.
Ce-rot′ic.
Ce-ryl′ic.
Ce-trar′ic.
Ce-tra′rin (Cet′ra-rin).
Ce-tyl′ic.
Cev-a-dil′lic.
Cev′a-dine.
Chav′i-cin.
Chav′i-col.
Chel-e-ryth′rine.
Chel-id′o-nine.
Chel-i-do-xan′thine.
Chi-maph′i-lin.
Chi-noid′ine.
Chi-rat′in.
Cho-lal′ic.
Chol-e-pyr′rhin.
Cho-les′ter.
Chol′ic.
Chlo′ral-ose.
Chry-sat′ro-pic (Chrys-a-trop′ic).
Chrys′o-phan.
Chrys-o-phan′ic.
Cim-i-cif′u-gin.
Cin-chon′i-cine.
Cin-chon-i-di′na.
Cin-chon′i-dine.
Cin-cho-ni′na.
Cin′cho-nine—(Sin′).
Cit′rine.
Cit-ron-el′lal.
Col-chic′e-in.
Col-chi-co-res′in.
Col-o-cyn-the′in.
Col-o-cyn′the-tin.
Con-cus′co-nine.
Con′i-ce-ine.
Co-ni′ic.
Con-val-la-ma′re-tin.
Con-val-la-ma′rin (Con-val-lam′a-rin).
Con-val-la-re′tin.
Con-val′la-rin.
Co-nyd′rine (Co-ny′drine).
Cor-dil-le′ra—(la′).
Co-tar′nine.
Cou′ma-rin.
Cre′o-lin.
Cres′al-ol.
Cre′sol.
Cro′ce-tin.
Cu′pre-ine.
Cys′to-gen.

Daph′ne-tin.
Der′ma-tol.
Di-ap′the-rin.
Dig′a-lin.
Dig-i-tal-et′in.
Dig′i-tal-in.
Dig-i-ral-os′min.
Dig-i-to-flav′on.
Dig-i-to-le′ic.
Dig-it′o-nin.
Dig-i-toph′yl-lin.
Dig-i-tox′in.
Dig′it-sa′po-nin.
Di-pen′tene.
Di-u-re′tin.
Du-boi′sine.
Dul-ca-ma′rhe-tin (Dul-ca-ma-rhet′in).
Dul-ca-ma′rin.
Du-o-de′num.

E-lat′e-rid.
El′e-mi.
El-em′ic.
El-e-op′tene.
El-lag′ic.
Em′e-tine.
Em′o-din.
Ep-i-neph′rine.
Er′ga-mine.
Er-go-chry′sin.
Er-go-ti′na.
Er′go-tine.
Er-go-tin′ic.
Er-got′i-nine.
Er′go-tol.
Er-go-tox′in.
E-ric′o-lin.
Er-i-o-dic-ty-on′ic.
E-ryth-ro-cen-tau′rin (Er-y-thro-cen-tau′rin).
E-ryth-ro-phlœ′ine (Er-y-thro-phlœ′ine).
E-ryth-ro-re′tin (Er-y-thro-re′tin).
E-ser′a-mine.
E-ser′i-dine.
Eth′yl-ene.
E-thyl′i-dene.
Eu′ge-nol.
Eu′pho-rin.
Eu′ro-phen.
Ex-al′gin.

Fab-i-an′ine.
Fe-lic′ic—(lis′).
Fer-u-la′ic.
Fer′u-lic.
Fer′u-lyl.
Fil′i-cin.
Fil-i-cin′ic.
Flu-id-glyc′e-ra′tum.
For-mal′de-hyde.
For′ma-mide.
For-man′i-lid.
Fran-gu-lin′ic.

Gal-lac-e-to-phe′none—(las).
Gal-lan′i-lide.
Ge′lose.
Gel-se′mic.
Gel-se-min′ic.
Gel-se′mi-nine.
Gen-ti-an′ic.
Gen′ti-an-in.
Gen′ti-an-ose.
Gen-ti-o-pic′rin.
Gen-tis′ic.
Gi-tal′in.
Gi′tin.
Glu′cin.
Glyc-e-ro-gel′a-ti′num.
Gly-co-chol′ic.
Gly′co-coll.
Glyc-yr-ram′a-rin.
Glyc-yr-rhet′in.
Glyc-yr-rhi′zic.
Glyc-yr-rhi′zin—(Glys) (Gly-cyr′rhi-zin).
Guai-ac′ic—(as′).
Guai′a-cin—(Gwi′).
Guai-a-con′ic.
Guai-a-ret′ic.
Gur-ju′nic.

Ha-ma-te′in.
Hash′ish.
Hel-le-bo-re′in.
Hel-le-bo-res′in.
Hel-le-bor-et′in.
Hep-ta-to′sane.
Hes-per′e-tin.
Hes-per′i-din.
Hex-a-meth′yl-en′a-mine.
Ho-mat′ro-pine.
Ho-mo-quin′ine (Ho-mo-qui-nine′).
Hy-drac′e-tin—(dras′).
Hy-dro-e-lat′e-rin.
Hy-dro-quin′ine.
Hy-dro-qui′none.
Hy-drox-yl′am-ine.
Hy-os′cine.
Hy-os-cy′a-mine.
Hy-os-cy-pic′rin.
Hy′o-sin.
Hy-poph′y-sis.

Ich′thy-ol.
In-fla′tin.
I′o-dol.
Ip-u-ran′ol.
I-so-a-myl′a-mine.

Je-co′le-ic.
Ju′ni-per-in.

Kryp′to-nine.

Lac-to-phen′in.
Lec′i-thin—(Les′).
Li-chen′ic.
Li′chen-in.
Li-mo′nene.
Lo-be-lac′rin.
Lo-be′lic.
Lo′be-line.
Lo′so-phan.

Man-del′ic.
Man′ni-tan.
Mar-ru′bi-in.
Mas-tic′ic—(tis′).
Mas′ti-cin.
Mel′i-tose.
Me-liz′i-tose.
Men′thene.
Men′thol.
Men-y-an′thin.
Met-a-co-pai′vic.
Meth-ac′e-tin—(as′).
Meth′yl-al.
Meth′yl-co-ni-ine.
Meth′yl-ene.
Me-thys′ti-cin.
Mor′rhu-ine.
Mor′rhu-ol.
Mus′ca-rine (Mus-car′ine).
Myr′o-sin.
Myr-ox-o-car′pin.
Myr-rhe′nol.
Myr′rhol.

Neil-gher′ry—(Nel-ger′e).
Ni-co′ti-an-in—(ko′shi).
Nic′o-tine.

Pal′len-in.
Pa-naq′ui-lon—(nak′wi).
Pap-a-yo′tin.
Pa-ral′de-hyde.
Par-ar′ab-in.
Pa′ri-cine.
Pa-rig′e-nin.
Pa-rig′lin.
Pay′tine.
Pel-le-tier′ine.
Pen′tal.
Pet′ro-se-line.
Pet-rox′o-li′num.
Phæ-o′re-tin(Phæ-o-re′tin)
Phe-nac′e-tin—(nas′).
Phe′no-coll.
Phe-nol-phtal′ein.
Phe′nyl-cin-cho-nin′ic.
Phlob′a-phene.
Phlo-ro-glu′cin.
Phy-set′o-le-in.
Phy-to-lac′ic—(las′).
Phy-to-lac′cin—(lak′sin).
Phy-tos′ter-in.
Pic-rac′o-nine.
Pic-rac-on′i-tine.
Pi-lo-car′pi-dine.
Pi-per′a-zine.
Pi-per′i-dine.
Pip′e-rine.
Pip-er-o′nal.
Pod-o-phyl-lo-quer′ce-tin.
Pod-o-phyl-lo-tox′in.
Po-lyg′a-lite.
Proph′e-tin.
Pros-en-chym′a-tous.
Pro-tar′gol.
Pseu-dac′o-nine.
Pseu-dac-on′i-tine.
Pseu-dac′o-rus.
Pseu-dat′ro-pine.
Psy-chot′rine.
Pur′pu-rin.
Pyr-o-guai′a-cin.

Que-bra′chine.
Quer′ce-tin.
Quer′cit-rin.
Quin-am′i-a.
Quin-am′i-cine.
Quin-a-mi′na.
Quin′ic.
Quin′i-cine.
Qui-ni-di′na.
Quin′id-ine.
Qui-ni′na.
Quin′ine—(Kwin′)
(Qui′nine)—(Kwi′).
Qui-no′vic.
Qui-no′vin.

Res-or′ci-nol.
Rham′ne-tin.
Rham-no-ca-thar′tin.
Rham-nox-an′thin.
Ri′cin.
Ric-in-e-la-id′ic.
Ri-cin′ic.
Ric-in-o′le-ic—(Ris).
Ric-in-o′le-in.
Ric-i-nol′ic.
Rot′tle-rin.
Ru-be-ryth′in.

Sal-ac′e-tol—(as′).
Sa-lig′e-nin.
Sal-i-py′rine.
Sal-i-re′tin.
Sal′u-tol.
Sal′ve-ol.
Sa-pog′e-nin.
Sap′rol.
Sar′ko-sine.
Sar-sa-sap′o-nin.
Scam′mo-nin.
Scil′le-tin.
Scil-le-tox′in.
Scil-li-pic′rin.
Scle-ren-chym′a-tous.
Scler-o-crys′tal-lin.
Scler-oi′o-din.
Scler-o-mu′cin.
Scler-o-tin′ic.
Scler-ox-an′thin.
Sco-po′la-mine.
Scroph′u-la-rin.
Scu-tel′la-rin.
Scy-chelles.
Sen′nac-rol.
Sen-na-pic′rin.
Ses′a-min.
Sin-al′bin.
Sin′a-pene.
Sin′a-pic.
Sin′i-grin.
So-lan′i-dine.
Sol′a-nine.
So′zal.
So-zo-i′o-dol.
So-zo-i-o-dol′ic.
Staph-is-ag′rine.
Ste-a-rop′tene.
Sto-res′in.
Stro-phan′thi-din.
Styr′a-cin.
Sty′ro-lene.
Sulph-am′i-nol.
Sul′pho-nal.
Su-pra-re′nal.
Su-pra-ren′a-lin.

Ta-rax-a′ce-rin.
Tau-ro-chol′ic.
Ter′pene.
Ter-pin′e-ol.
Ter′pin-ol.
Tet′ro-nal.
The-oph′yl-line.
The-rop′ic.
Thi′o-phene.
Thi-o-son′a-min.
Thu-jig′e-nin.
Thym-ac′e-tin—(as′).
Trag-a-can′thin.
Tre′ha-lose.
Trig-o-nel′line.
Tri′o-nal.
Tro′pine.
Tu-li-pif′er-ine.

Um-bel-lif′e-ron.
U′re-thane.
Ur′son.

Ver-a-tral′bine.
Ver-a-tram′a-rin.
Ver-a-troi′dine.

Xan′thin—(Zan′).

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